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PAVING SEWERAGE MUNICIPAL ENGINEERING WATERWORKS PARKS

A MONTHLY MAGAZINE.

DEVOTED TO THE IMPROVEMENT OF CITIES.

GOOD ROADS, STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION,
BRIDGES.

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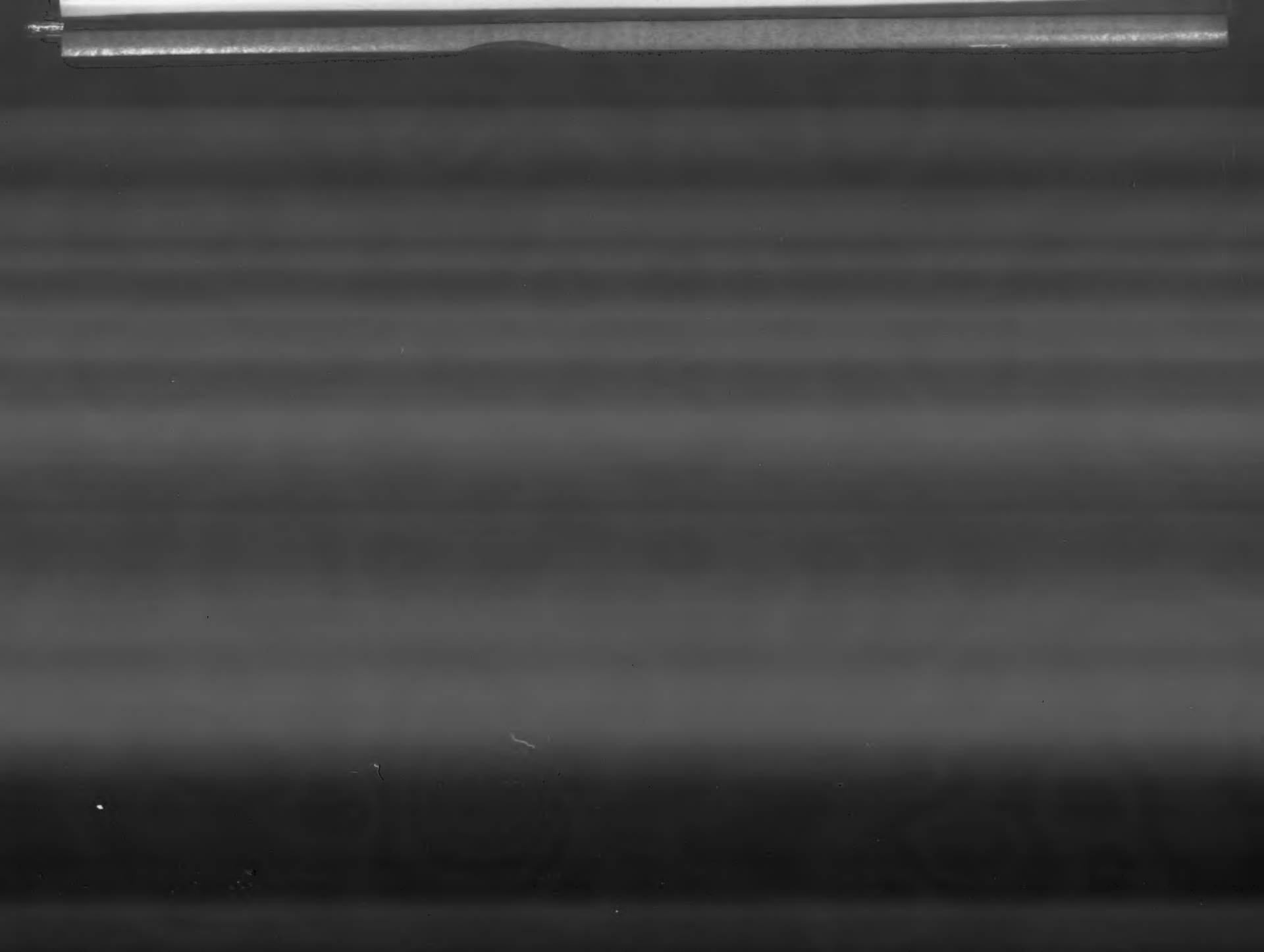


Municipal Engineering

VOLUME XIII. OCTOBER, EIGHTEEN NINETY-SEVEN. NUMBER 4.

ARTIFICIAL STONE PAVEMENTS.

By Robert Grimshaw, C. E.

The following paragraphs are intended to present the state of the art in Europe of what the Germans call "artificial stone" pavements, including therein brick ("clinkers"), "Keramit" slabs, etc. They are taken from recent German authorities:

(1) "*Clinker*" *Paving.*—In the low-lying countries of North Germany, especially in Hanover and Oldenburg, and in the Netherlands, where natural stone is lacking, but good fire-clay or brick clay are plenty, there has long been employed for street paving a special kind of brick which, from its hard character and ringing tone when struck with the hammer, has received the appropriate name of "clinker," as distinguished from other "backstein" or "baked stone."

These bricks are made from ordinary "thon" or ordinary brick clay, without any additions or special preparation, and burned to vitrification. In order to secure more thorough burning than is usual or necessary for building bricks, the size of the clinker is such as to produce, when burned, dimensions of only 23 x 11 x 5 centimeters (say 9.2 x 4.4 x 2 inches), which is considerably smaller than for building purposes. It is important to secure even and regular burning, and to use for any one part of a street only the bricks from one burning. Good clinkers must be regular in shape, equal in size, straight and flat, and free from blisters and cracks. They should not be glazed on their outer surface, but burned hard clear through and with a somewhat roughish face; and when struck with the hammer should give out a clear, sharp, ringing tone. Their color varies, those from "klai" or "klei," which is the upper layer, and evidently gives us our general word "clay," being yellowish, and those of "lehm" or loamy clay and "thon" or fire-clay more properly, bluish-red.

The method of laying is usually that long ago prescribed in Hanover, as follows:

The under-bedding should be of gravel or coarse sand without any vegetable matter; and the upper-bedding should have in it no large pebbles.

This bedding is well rammed with iron rammers, and brought to the approximate cross-profile, slightly convex. It is especially cautioned that the ramming be thorough, so as to avoid leaving loose or low places; a second ramming being recommended. The depth is 12 to 16 inches.

Borders are usually made of nat-

ural stone, clinkers being used only when stone is lacking. They consist of one row of stone, with the upper faces raised above the clinkers, and usually bonded with the latter by one or two rows of clinkers. These last distribute the pressure on the natural stones. The first row of border clinkers lies about 0.4 inch below the level of the adjacent road-surface; then each successive row is sunk about an inch more. On the middle row clep bricks are laid to fill the space; these must be at least half a brick long. Figure 1 shows a section of the border and adjacent road-face. The cross-slope of the street has a versine of $\frac{1}{50}$ to $\frac{1}{30}$ the chord.

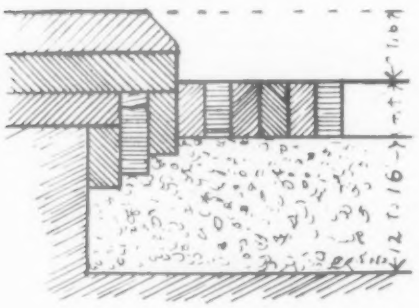


FIG 1.

The bricks are laid lengthwise of the street, in rows running crosswise, thus giving a thickness of road-face of half a brick. The rows are started at the borders. The first rows are laid to the under edge of a concave templet, and the rest to the upper edge of a convex one; the height of the center line of the street being previously laid down by flat stones.

The bricks are laid with the closest possible joints, several rows being laid each lacking one, and their openings coming in line. Then a "keystone" brick is driven, with a hammer, into each row, the surface being protected from breakage by a board. Thus the joints are made close. Care is taken that the row is not sprung upwards by the wedging. The first eight to ten rows are keyed up separately.

The best, hardest and most regular bricks are laid where the most weight and wear come—where the street is not very wide, thick stripes, about 2 to 2½ feet apart, each side of the center line; and on very narrow streets there is only one such specially-good stripe.

When the bricks have been laid along about 80 feet they are sprinkled, and any which may slightly project are rammed flush with a wooden paver, while any which lie too low are hooked out and brought up to level. Then clean, dry sand is strewed over the surface, swept into the joints, and, while being sprinkled, is crowded in with short, stiff brooms until the joints will hold no more.

In order not to soften the bed, the watering is not continued long in any one place, but is spread out over several days. Before strewing the sand, the bricks are well watered in order to find any joints that are too pervious.

When all the joints are packed, a sand-layer half an inch thick is spread evenly over all.

Great care must be taken to guard clinker pavements from frost, and also from excessive wetness. To this end they should be well underdrained, or at least have a very steep cross-profile.

At crossings or at intersections of two brick-laid streets, the clinkers are laid herring-bone fashion, in the direction with regards to the street, shown in figure 2.

At sharp bends, the bricks are set (if bricks are used here), at an angle of 45° to the radius of the curve; but it is considered preferable to use stone here. Stone paving is also recommended where

unpaved streets enter the "clinker" streets, and a drawing up of "fat" soil by reason of paving of the ascents can not be thoroughly obviated.

(2) *"Keramit" Slab Paving.*—In Buda-Pesth (Ofen), Hungary, some streets are paved with terra-cotta slabs 20x20 or 10x20 cm. (say

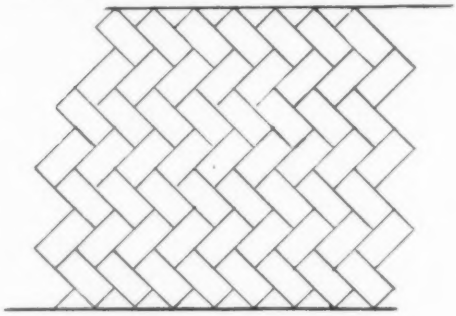


FIG. 2.—"KLINKER" CROSSING.

8x8 or 4x8 inches), set (at least formerly), on a rolled layer of brick in mortar.

(3) *Slagstone Paving.*—Of all artificial paving material, slagstone is here preferred. Sometimes this is hacked out of large masses of solidified high-furnace slag, sometimes the still-liquid slag is run into molds and let cool very slowly. This gives an exceptional degree of toughness, making the material especially to be recommended for paving; only the smoothness of such blocks from most slags being found undesirable.

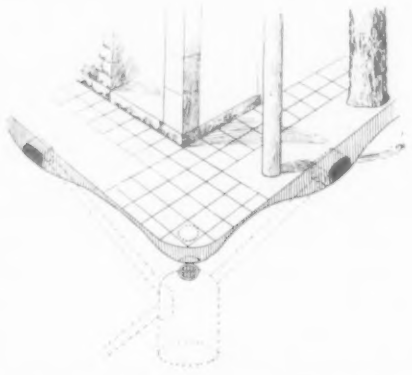
While many experiments have been made, and others are now being made, over paving with artificial material, the results are not yet sufficiently available. In particular, however, may be mentioned trials in Munich and Nuremberg with an artificial stone made by Hess & Co., of Oberkotzan in the Fichtelgebirge. The principal material is pulverized serpentine, with a binding substance, hydraulically pressed in steel molds and then baked or burned in kilns such as are used in porcelain manufacture. The blocks are 6 inches high, 4.4 inches wide, and 7.2 inches and 10.8 inches long, and are notable for hardness, toughness, enduring grittiness of surface, and immunity from noise when under traffic.

STREET INLETS.

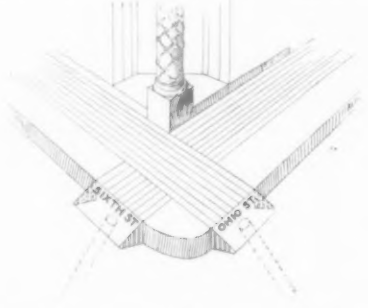
City Engineer J. W. Wilcox, of Macon, Ga., sends the accompanying sketch of the inlets used in that city. They are well located to prevent water running over the crossings for foot passengers, and should be very successful on the upper sides of crossings where there is sufficient gradient in one direction or another to carry the water from the center of the intersection of the two streets. When the streets are level, or nearly so, the elevation of the gutter at the curb corner makes the cross-section of the street on the diagonal through the center of the intersection too nearly a straight line to make the drainage at all

satisfactory. If the catch-basin is located at the curb corner, and the sidewalk is wide enough to permit, the gutter can be lowered again at

this point and a grating on the top of the basin or a hole in the curb will admit the small amount of water draining from the intersection, and will materially improve



the drainage of the area of the intersection, always difficult to attain satisfactorily. If the inlets are set a few feet back from the property line, instead of on it, as in the sketch, the rise of the pavement to the curb can be more gradual and so less unsightly, and less conducive to accidents. If the sidewalk is next the property line and there is a lawn of reasonable width, as is



generally possible on residence streets, the return of the gutter to a proper depth for good drainage at the curb corner is facilitated. It is possible in such case to bring the pavement up to the level of the top of the curb where foot passengers travel.

Several forms of grade-crossing similar to the sketch and the suggested modifications are in use in Indianapolis, Frankfort, Ind., Bloomington, Ill., and other places, and are very satisfactory, except when the area of the intersection is made too nearly level, the transverse slope being reduced by raising the gutter at the corner where it should be lower if possible, and when the horizontal grating is required to take a large amount of water, in which the floating debris will clog it and cause an overflow.

Additional advantages in having the catch-basin top in the gutter, or at the curb corner, are that the smoothness of the sidewalk is less broken and the walk is not so likely to be fouled when the basin is cleaned.

When inlets to the sewers are used, the basin being omitted, the method used in Bloomington, Ill., is quite convenient. The street is raised and the cross-section is flattened, as in the other cases, but an iron plate is placed at the curb, this plate being the width of the sidewalk. At each end of this plate is a grating, to stop floating debris, and underneath it is an opening pipe running to the sewer. The gutter is lowered at the curb corner to drain the intersection thoroughly. The objection to this form is the vertical obstruction to travel formed by the ends of the plates. The location of catch-basins under plates would be objectionable when cleaning became necessary. The names of the streets may be cast in the plate in large letters and thus made a prominent street-sign.

CHARGES FOR ENGINEERING SERVICES.

In continuation of this subject from page 91 of the August number of MUNICIPAL ENGINEERING, the following table is presented, giving the schedule of minimum percentage charges for civil engineers in professional practice adopted by the California Association of Civil Engineers eight or ten years ago:

	Cost of Work.							
	Less than $5,000	$5,000 to $10,000	$10,000 to $20,000	$20,000 to $50,000	$50,000 to $100,000	$100,000 to $200,000	$200,000 to $500,000	Over $500,000
Preliminaries ..	1.5	1.0	0.8	0.6	0.5	0.4	0.3	0.2
Plans and Specifications..	2.5	2.0	1.8	1.6	1.4	1.2	1.1	1.0
Details	1.0	1.0	0.8	0.6	0.4	0.3	0.2	0.1
Supervision	1.7	1.5	1.3	1.1	0.9	0.8	0.7	0.6
Engineering Superintendence	3.5	3.0	2.5	2.2	1.9	1.6	1.4	1.2
Alterations*	6.0	5.0	4.5	4.0	3.4	3.2	3.1	3.0

*The percentages noted in the case of alterations are to be computed on the value of the work involved in the alteration, not on the cost of the whole work.

When employed on a per diem basis, the charges for services should not be less than $10 a day for self or representative and expenses. When in charge of work as resident engineer on a per diem basis, the compensation should not be less than $15 and expenses.

Detailed explanations are omitted, as the above is almost self-explanatory. An additional table of minimum charges for property subdivisions is given and general provisions are made for professional advice, expert work and consultation. An excellent paragraph is this: "Consultation with engineers who have made certain branches of professional work a specialty, or who have acquired a pre-eminent standing in the profession, may be requested by the engineer having general charge of any work, or may be required by the owner thereof. In either case the employment of the consulting engineer must be satisfactory to both owner and engineer, and shall be at the expense of the owner. No engineer should agree to act as consulting engineer except at the request or with the consent of the engineer in direct charge of the work; and his reports and advice should be confined to the particular matters with reference to which he has been consulted."

Discussion of this schedule and presentation of others is invited.

NEEDED ENLIGHTENMENT AS TO PUBLIC AFFAIRS IN SAN FRANCISCO.

It is not too much to say that the underlying difficulty to the improvement of municipal affairs in San Francisco is the serious lack of confidence in public morality existing among her citizens. Public morality, by which is meant the honest performance of public duties, to the extent even of refusing to accept positions, the duties of which one is not prepared by training, ability, or by time at his disposal, to adequately perform, has not been often in evidence in the conduct of her municipal affairs. The most honorable citizens have allowed their names to appear as members of commissions and on special investigating committees, and have signed the reports made by these bodies, without any adequate understanding or comprehen-

sive grasp of the conditions to be affected by these reports. Is it any wonder then that when improvements costing large sums of money are proposed, the average citizen questions all things? Other cities find it difficult to bring about reform in some single department of city government. San Francisco needs reform, not only in the departments, not alone even in the government itself, but most of all a change of sentiment in the minds of her citizens producing local patriotism and civic pride, and the confidence born of those feelings. She needs citizens in fact instead of a mere population. This has always been a city of migratory people, and at this western limit of America, this migration has been compelled to turn back, in thought at least if not in reality, to eastern homes.

Some of the true citizens of San Francisco realize the necessity of educating the population into citizenship. But how was it to be accomplished? Not merely by precept and example, for these were never wanting entirely. Individual interest must be awakened and opportunity for steady co-operative action provided, which should work from details toward general interests. With this idea the Merchants' Association was formed some three years ago, and has been conscientiously maintained since by the unselfish labor of its organizers. It has grown from a membership of less than fifty to nearly a thousand, and while lending assistance to all work of improvement, it does not seek to control such work, but confines itself to the idea of education in civic sentiment, and to the spread of detailed information on municipal affairs.

To illustrate the work being done: Recently there were gathered by invitation for an evening conference in the rooms of the association, the teamsters, the representatives of different drayage, express and baggage delivery companies and of the delivery departments of the large mercantile firms. The subject was pavements from the point of view of the men driving over them. A number of specimens of paving materials, both new and blocks taken from old pavements showing the wear, were on the table to be examined by all. The men as they came in were made to feel at home and encouraged to talk, being led to give their experience in driving on the different pavements of the city. When the meeting was called to order the chairman, after stating the object of the meeting, gave a brief history of the association's efforts to learn something of the different pavements in use in different cities of the world during the past year; also some particulars in certain specifications in regard to manner of laying, time of guarantee, method of making repairs, etc., in Paris, in some of the German cities and in Australia, exhibiting some specimens of wooden block pavement from Australia that had been in use for fifteen years.

Returning then to San Francisco affairs, he explained that the city allowed only one kind of pavement and had only one set of specifications aside from basalt blocks laid in sand, and that was for bituminous rock. The Merchants' Association, he said, had had specifications drawn up for three other pavements, asphaltum, basalt blocks on concrete foundation, and wooden block pavements, which it was hoped the city council would adopt and allow laid under a ten year guarantee where property owners desired. He then

called on the engineer of the association, Mr. Ernest McCullough, to explain these pavements, and answer any questions those present might ask. Mr. McCullough, who enters thoroughly into the educational spirit and aims of the association, explained clearly the technical phraseology of the specifications and showed the necessity of the distinctions made. Thus, in bituminous rock pavement, the quality depends not only on the per cent. of bitumen to sand, but also on the per cent. of fixed and volatile carbon, since the volatile oil will exude and leave the pavement friable or crumbly, and also on the per cent. of sharp sand to loam, and other impurities in the rock. In block pavements a great improvement results from the requirement that only blocks of the same width be laid in the same row across the street, and a less variation allowed in the thickness where laid on concrete foundation.

The questions asked by the men present were many and varied and their remarks on certain pavements in the city were center shots. As teamsters they were, of course, not in favor of wide-tire ordinances. The foundations must be just as strong and expensive regardless of an inch more or less in width of tire, and one of the requisites of a good pavement in their eyes was that it accommodate the tire most economical for the wagon. A pavement should not be too smooth. Horses must get a foothold to start a load on a level street or pull it on a grade, so the grouting of cement or asphaltum between joints on block pavements should not reach clear to the surface.

The result of this meeting was a feeling of union of interests and a realization of the careful business methods necessary for success in the improvement of municipal affairs. Knowing that such meetings, calling together different classes of citizens, and presenting various subjects from various points of view, have been held at least bi-monthly for three years, we may understand the good work being accomplished by this association.

THE FILTRATION OF WATER.*

By Edmund B. Weston, M. Am. Soc. C. E., M. Inst. C. E., Consulting Engineer, Providence, R. I.

The value of filtration for the purification of water has long been recognized by scientists. Among the facts which can be mentioned in favor of the filtration of questionable water supplies are the following: The removal of turbidity; the removal of taste and odor; the prevention of typhoid fever, cholera, diarrhœa and dysentary. Statistics show conclusively that in communities where efficient filters are used for the purification of water supplies, that the yearly death rate has been largely reduced since the introduction of filtration.

It is the intention of the writer to discuss and describe in this paper the purification of water by sand filtration and by mechanical filtration aided by the application

* Read before the National Convention of Mayors and Councilmen, at Columbus, Ohio, September 30, 1897.

of chemicals. This latter combination will be hereafter mentioned in this paper as the American system of filtration.

The ideas and opinions of the writer which are presented are based upon a long study of different methods of filtration; upon personal examinations of existing filter-plants in the United States and Europe; upon personal experience gained by designing filter-plants, and upon knowledge derived from the results of a series of experiments with sand filters and filters representing the American system of filtration that were conducted under the personal direction of the writer, at Providence, R. I., from February, 1893, to February, 1894.

Water can be satisfactorily purified by sand filtration, or by the American system of filtration, and either of these methods of filtration can be depended upon, if they are well managed, to remove, on the average, from ninety-seven to ninety-nine per cent. of the ordinary bacteria contained in water, and very nearly one hundred per cent. of the typhoid fever germs, if there should be any present in the water that is being filtered, provided that filters are employed which are constructed in a first-class manner, and in accordance with the latest knowledge that has been derived from experimental experience.

SAND FILTRATION.

An ordinary sand filter may be briefly described as a tight reservoir, properly underdrained, and containing a bed of five or six feet deep of stratified filtering material, of increasing degrees of fineness, commencing at the bottom with broken stone or coarse gravel, and ending at the top with a layer of two or three feet of fine sand. The unfiltered water is run on to the top of the filter-bed, and is generally maintained at a depth of about four feet above the same. The purification of the water takes place during its passage down through the filter-bed to the underdrain.

The rate of filtration through the English filters averages about 2,000,000 gallons per acre per twenty-four hours. The Lawrence City filter was designed to filter at an average rate of 2,000,000 gallons per acre per twenty-four hours, and the filters recently constructed at Hamburg, Germany, filter at an average rate of about 1,700,000 gallons per acre per twenty-four hours. In Germany, by direction of the Imperial Board of Health, the maximum rate of filtration has been fixed at four inches per hour, which is equivalent to about 2,600,000 gallons per acre per twenty-four hours.

A filter-bed, after it has been in operation during more or less time, becomes clogged, on account of a slimy layer that gradually accumulates upon the top of the filter-bed, which consists of a jelly-like substance of bacterial formation, and the matter formerly in suspension in the water. When the resistance due to the clogging of the filter-bed gets to be too great to allow the passage of the water through it at the desired rate, it is necessary to scrape the top of the filter-bed. This is done, after the water has been drawn off, with sharp shovels or hoes, and about one-half of an inch of the top of the filter-bed is removed each time that it is scraped. This surface-layer, before it causes too much resistance to allow the passage of the water through the filter-bed at the desired rate, is decidedly beneficial, as it acts as a very fine strainer.

The quantity of water filtered per

acre, between the times that a filter-bed is scraped, depends upon the condition of the water being filtered. In a number of German filter-beds the average quantity filtered per acre between scrapings has not been far from 50,000,000 gallons. In the English filter-beds the number of gallons filtered between scrapings is much greater on account of the large sizes of the sedimentation basins through which the water passes before it reaches the filter-beds. It has averaged as high as 88,000,000 per acre.

It may be assumed that the period which elapses between the times that the majority of filter-beds are scraped ranges from one to six weeks; varying according to the rate of filtration, the size of the sedimentation basins, if they are used, and, as stated above, upon the condition of the water being filtered.

In good practice, the sand removed from a filter-bed by scraping is replaced about once a year with new sand, or with the sand that has been removed, after it has been thoroughly washed.

At various places in Europe the filtered water is wasted for a time, immediately after a filter-bed has been scraped. It appears to be the rule at Berlin, Germany, and of a number of the London water companies, and in accordance with the best German authority, to allow the water to stand in a newly scraped filter for about twenty-four hours before filtration is commenced, in order that a thin layer of deposit may be formed upon the filter-bed. At Altona, Germany, the water is generally allowed to stand from ten to twelve hours in a newly-scraped filter, previous to its being put in operation, and if a filter has had new sand placed in it, the filtered water is allowed to waste for several days before being considered suitable for use. The Lawrence City filter does not appear to be disadvantageously affected by being scraped. This filter, however, is generally worked intermittently; that is, after a certain length of time the application of the water is discontinued and the filter-bed allowed to drain and get thoroughly aerated before water is again applied.

European experience, as well as that with the Lawrence City filter, shows, on account of the difficulty in scraping a filter-bed when it is covered with thick ice, that it is advisable to cover or roof over a filter, if, at the place where it is located, the mean temperature of the coldest month of the year is below the freezing point.

The percentage of water bacteria removed (that is, the percentage showing how much less the number of bacteria was in the filtered water than it was in the unfiltered water) by the Lawrence City filter and the best Europeon filters, averages, for the entire year, between ninety-seven and ninety-nine per cent. The reports of the Massachusetts State Board of Health for the years 1893, 1894 and 1895, give the average percentage of water bacteria removed by the Lawrence City filter as: 97.58 per cent., 98.46 per cent. and 98.22 per cent. The percentage of bacteria removed by some of the experimental filters used at the experiment station of the State Board of Health of Massachusetts, has averaged, "for months at a time," between ninety-nine and one hundred per cent. The percentage of bacillus prodigiosus removed by these experimental filters, has been very nearly one hundred per cent. The life history of the bacillus prodigiosus is similar to

that of the bacillus typhi abdominalis, and it was added to the water before it was filtered, in order to ascertain the efficiency of the filters in regard to the removal of typhoid fever germs.

Experimental filters at the experiment station of the Massachusetts State Board of Health during the year 1894, removed forty-three per cent. of color and fifty-five per cent. of albuminoid ammonia from the applied water.

The Lawrence City filter that has been mentioned in the preceding pages, which the writer considers the representative sand filter of the United States, has an area of filter-bed of two and one-half acres and has been in operation about four years. The construction of the filter was based upon the results of a long series of valuable and elaborate experiments that were conducted at the experiment station of the Massachusetts State Board of Health. About two years ago the designer of the filter recommended that it be roofed over, owing to the difficulty experienced in scraping the filter-bed in winter on account of thick ice forming over it, thereby reducing its efficiency as well as increasing the expense of maintenance.

COST OF SAND FILTRATION.

The following estimates were prepared by the writer, and represent first-class design and construction. They were based upon an average rate of filtration of 2,000,000 gallons per acre per twenty-four hours, and a maximum rate of 2,500,000 gallons:

Filter-beds covered with masonry vaulting.

Cost per acre of filter-bed	$70,000 00
Cost of construction, per 1,000,000 gallons capacity per 24 hours	35,000 00
Total cost of filtering 1,000,000 gallons, including expense of operating, interest, deterioration, etc	7 57

Filter-beds covered with a wooden roof.

Cost per acre of filter-bed	$43,813 00
Cost of construction per 1,000,000 gallons capacity per 24 hours	21,906 00
Total cost of filtering 1,000,000 gallons, as above	6 85

Filter-beds, not covered.

Cost per acre of filter-bed	$38,829 00
Cost of construction per 1,000,000 gallons capacity per 24 hours	19,415 00
Total cost of filtering 1,000,000 gallons, as above	6 48

Filter-beds, not covered.

Cost per acre of filter-bed	$31,063 00
Cost of construction per 1,000,000 gallons capacity per 24 hours	15,532 00
Total cost of filtering 1,000,000 gallons, as above	5 09

The first three estimates are intended for filter-plants that could be located where the mean temperature of the coldest month of the year is below the freezing point. The third estimate takes into consideration a reserve area to compensate for ice forming over the filter-beds. The fourth and last estimate is intended for a filter-plant that could be located where the mean temperature of the coldest month of the year is above the freezing point. None of the estimates include the cost of sedimentation basins.

THE AMERICAN SYSTEM OF FILTRATION.

A filter, of the best type, of the American system of filtration, can be roughly described as a tight, upright cylinder of wood or steel, having a bottom, but open at the top, containing a bed three or four feet deep of finely crushed quartz or fine sand, which is placed over finely perforated disks that are located at the bottom of the cylinder and attached to collecting pipes. These perforated disks allow the water to pass through them during the different operations of working the filter; downward while filtering, and upward during the

process of washing the filter-bed. They prevent the sand or quartz, or any foreign substance, from entering the collecting pipes and passing off with the filtered water. The cylinder has also an inlet pipe, an outlet pipe connected to the collecting pipes, wash and waste pipes, and an adjustable mechanical rake or agitator for stirring up the filter-bed when it is being washed.

The filtered water flows on to the top of the filter-bed and thence down through it, and the perforated disks, to the collecting pipes. The chemicals are systematically added to the unfiltered water, by a small pump, before it enters the filter.

The rate of filtration of the American system of filtration is very high in comparison with the rate of filtration of sand filters. Consequently, a filter-bed of the American system has, on account of getting clogged, to be washed much more frequently than sand filter-beds are scraped. A filter-bed can be thoroughly washed, however, in about ten minutes. The length of a run of a filter, or the length of the period which elapses between the times that a filter-bed is washed, is dependent upon the condition of the water that is being filtered. During the Providence experiments it averaged about seventeen hours.

Too much time would be required to discuss in detail all of the chemicals that have been most frequently used in the purification of water, and, as within the writer's experience, the use of sulphate of alumina has given the best results, it will be the only chemical which will be discussed hereafter in this paper in connection with the American system of filtration. The sulphate of alumina is applied to the water, in the best practice, in the form of a coagulant. The coagulant used during the Providence experiments was composed of one part of sulphate of alumina dissolved in seven parts of water.

The clogging of the filter-bed is due to the gradual accumulation upon its top of a layer consisting of aluminic hydrate and matter formerly in suspension in the water. To this layer the efficiency of the filtration is largely due, as it acts during filtration as a very fine strainer, and in a manner similar to that of the slimy layer that has been mentioned as forming upon the top of a sand-filter bed. When the resistance, due to the clogging, gets to be too great to allow the passage of the water through the filter at the desired rate, it is necessary to wash the filter-bed.

The theory of the American system of filtration, when sulphate of alumina has been added to the applied water, may be described as follows: The alumina causes an artificial precipitation. A portion of the alumina is decomposed, forming sulphates of other bases and a flocculent precipitate of aluminic hydrate. A portion of it also combines directly with the organic matter present in the water, coagulating the same and thus helping to increase the precipitation. The degree of color of the water is also largely reduced by the uniting of the precipitated aluminic hydrate with the coloring matter in the water. A sufficient quantity of the precipitate having been deposited upon the top of the filter-bed, it is ready for service.

The manner in which a filter is operated is as follows: At the end of a run, or immediately before starting the filter, the filter-bed is thoroughly washed by forcing up through the perforated disks and filter-bed a reverse flow of water

under pressure, the mechanical rake or agitator being operated at the same time, which adds materially to the efficient cleansing of the filter-bed. The water is forced up through the bed and the agitator kept in motion until the water flowing from the overflow drain-pipe is as clear as it was before it was used for washing the filter-bed. The necessary valves are then operated and the unfiltered water to which the sulphate of alumina is being added is turned on to the filter.

During the Providence experiments a very satisfactory rate of filtration was found to be 128,000,000 gallons per acre per twenty-four hours. At this rate a filter twelve feet in diameter would have a capacity of about 332,000 gallons per twenty-four hours, and a filter twenty-one feet in diameter, about 1,000,000 gallons per twenty-four hours.

The principal features of a first-class filter-plant, having a capacity of 20,000,000 gallons per twenty-four hours, can be roughly outlined as follows: A filter-house 250 feet long and sixty-four feet wide, containing a flume about eight feet wide, running lengthwise through its center, for receiving and taking away the filtered water; twenty filters, each of 1,000,000 gallons capacity, ten of which are located on each side of the flume; the supply and wash pipes for bringing the water to the filters; the drain pipes for removing the dirty water during the process of washing the filters; the steam pipes for sterilizing the filter-beds and heating the building; and all other necessary pipes and appurtenances. An engine and boiler-house sixty feet square, containing the boilers for supplying the steam; a pump for washing the filters; an engine for driving the shafts in the filter-house, which work, by the aid of belting the mechanical rakes in the filters when they are being washed; an automatic chemical pump for adding the sulphate of alumina coagulant to the water being supplied to the filters; the tanks for mixing and holding the coagulant; the arm-pump for aiding in the mixing of the coagulant, and the electric lighting and signaling apparatus, and a shed or small building for storing coal and sulphate of alumina in bulk.

The most efficient filter-plants that have recently been constructed make use of sedimentation tanks, as adjuncts to the filters through which the water passes before it enters the filters. These tanks are sometimes built independent of the filters, and sometimes they are located directly under the filters, the lower part of the cylindrical shell containing the filter-bed being arranged and utilized for the purpose. When sedimentation tanks are used, the sulphate of alumina coagulant is added to the water as it flows into the tanks.

It was demonstrated during the Providence experiments, that if any of the alumina found its way through the filter while the proper quantity was being added to the unfiltered water, that it was such a minute quantity that it could not be determined by the chemical analyses that were made, as the amount that was found in the filtered water was less than the amount found in the unfiltered water (one of the constituents of the unfiltered water being alumina before the sulphate of alumina was added to it.) Many chemical analyses have been made in different places, where filter-plants are in operation, in order to ascertain

if any of the applied alumina or alum that was being used, passed through the filters, and almost invariably the same result is reported; namely, that none of the applied alumina, or alum, was found in the filtered water.

Objections are sometimes raised against the American system of filtration, to the effect that it requires a great deal of care and attention. There are but few things which bring about successful results that do not require more or less care and attention. The principal details which have to be attended to during the operation of a large filter-plant are: The mixing of the coagulant; seeing that the proper quantity of coagulant is being added to the unfiltered water, which is easily done by adjusting the automatic chemical pump, to the required rate; the operating and care of the engine, pumps, boilers, and mechanism used for working the mechanical rakes during the washing of the filters; the opening and closing of the necessary valves which are made use of in washing the filters; the regulation of the quantity of water being supplied to the filters; and, about once in six months (dependent upon the character of the water), the sterilizing of the filter-beds, which is generally done by covering them with water, to which should be added a small quantity of soda ash, and then boiling the water by forcing steam into it from the boilers.

It is the opinion of the writer, that it does not require any more responsibility and attention, and possibly not as much, in running a large, first-class filter-plant, than it does to run an average plant of high grade pumping engines of the same capacity.

It was found during the Providence experiments that, by the American system of filtration, there could be removed from the unfiltered water 98.6 per cent. of the water bacteria; 99.97 per cent. of the bacillus prodigiosus, that was added to the unfiltered water in order to ascertain the efficiency of filtration in regard to disease germs; 70 per cent. of the albuminoid ammonia, and about 72 per cent. of the color.

The writer received a short time ago trustworthy information in regard to the bacterial efficiency of two large filter-plants that have recently been built; one of them is 6,000,000 gallons capacity and the other of 3,000,000. The results derived from eight samples of the unfiltered and filtered water that were collected on eight different days from the former plant, showed an average removal of water bacteria of 97.2 per cent.; and the results obtained from samples of the unfiltered and filtered water that were collected daily for three months from the latter plant showed an average removal of water bacteria of 97.9 per cent., the results of the last two months averaging 98.0 per cent.

COST OF THE AMERICAN SYSTEM OF FILTRATION.

This estimate was prepared by the writer and includes the cost of sedimentation tanks. It represents first-class design and construction, and was based upon an average rate of filtration of 128,000,000 gallons per acre per twenty-four hours:

Cost of construction per 1,000,000 gallons capacity per 24 hours	$13,500 00
Total cost of filtering 1,000,000 gallons, including the expense of operating, cost of sulphate of alumina at the rate of one grain per gallon at $1.75 per 100 pounds, interest, deterioration, etc	6 41

The above estimate is intend for a filter-plant that could be located anywhere without regard to the mean temperature of the coldest month of the year. For a climate where the mean temperature of the coldest month of the year is above the freezing point, the cost would be somewhat less. The writer considered one grain of sulphate of alumina per gallon in the estimate, as it may be considered as a fair general average of the quantity that would be required for a large number of differently constituted waters; some waters require less and some more; six-tenths of a grain per gallon was the average amount applied during the Providence experiments.

Several large and efficient filter-plants that have been constructed within the last two years did not exceed a cost of construction of $10,000 per 1,000,000 gallons capacity per twenty-four hours. The total cost of filtering 1,000,000 gallons, taking into account these figures instead of the $13,500 as given above, would be $5.73.

CONCLUSION.

It will be seen, by comparing the estimates of cost which are given in this paper, that the cost per 1,000,000 gallons capacity per twenty-four hours of an American system of filtration plant, as well as the cost of filtering 1,000,000 gallons, is less than that of a sand filtration plant.

A comparison of the third estimate of the cost of a sand filtration plant (which is the lowest of the first three estimates, and, therefore, may be considered conservative) with the estimate of the cost of an American system of filtration plant—namely, $19,415 and $6.48 for the former; and $13,500 and $6.41 for the latter—shows that the cost of construction per 1,000,000 gallons capacity per twenty-four hours of a sand filtration plant is about forty-four per cent. more than that of an American system of filtration plant, and the cost of filtering 1,000,000 gallons, about one per cent. more.

Experience has shown that the percentage of color removed is much larger by the American system of filtration than by sand filtration.

The percentage of removal of albuminoid ammonia has been shown to be larger by the American system than by sand filtration.

The percentage of removal of the applied bacillus prodigiosus, which represents typhoid fever germs, has been shown by experimental filters to be about the same for both systems.

As can be seen by the percentages given in this paper, the average percentage of removal of water bacteria of the Lawrence City filter, during three years, and that of an American system plant, during two months, is practically the same. The writer is of the opinion, however, that it is quite possible to build sand filters in this country which would be as efficient as the best European sand filters, and, although it may be quite possible that American system plants can be built which would be equally as efficient, the experience in regard to building and operating first-class plants of the latter system has not yet covered a sufficient length of time to enable the writer to express a positive opinion in this respect. He will, therefore, assume that the best European experience tends to show that a sand filter is one and one-half per cent. more efficient in the removal of water bacteria than the American system of filtration. If this assumption is

correct, does the extra cost of a sand filtration plant compensate for its one and one-half per cent. increase of efficiency in the removal of water bacteria? The writer is of the opinion that, possibly, in some cases, it might; but in many cases that it would not.

For instance; a sand filter plant having a capacity of 10,000,000 gallons per twenty-four hours, considering, as given above, an increase in the cost of construction of about 44 per cent., and an increase in the expense of operating, etc., of about one per cent., would cost $59,000 more than an American system plant of the same capacity, and the expense of operating per annum, etc., would be about $256 more. It should be remembered, as has previously been stated, that the figures of the cost of construction that have been considered in this comparison include the cost of sedimentation basins for the American system plant, but that they do not for the sand filtration plant.

The statement has sometimes been made, in regard to the American system of filtration, that "the use of alum is injurious to health." The writer has already discussed this objection quite fully, and it is hardly necessary for him to state that, in his opinion, there need not be any apprehension felt in regard to the use of alum or sulphate of alumina, if it is done in a manner which conforms to the latest experimental knowledge and practical experience.

In closing, the writer wishes particularly to emphasize the fact, that the opinions which he has expressed in this paper, in regard to the comparative efficiency of American system of filtration plants which are in actual service, have been based upon the operation of first-class plants that have been built in accordance with the most advanced knowledge (derived from late experimental research) that there is upon the subject. The writer also wishes to state that his opinions, as above mentioned, do not in any manner refer to the general run of mechanical filters which are in use in the United States or elsewhere.

THE FINANCIAL MANAGEMENT OF WATER-WORKS.*

By E. Kuichling, Chief Engineer of Water-Works, Rochester, N. Y.

The questions involved in the financial management of a municipal water-works system are often very interesting, even though they may be somewhat complicated; and it is doubtless owing to the difficulties encountered in the analysis of the problem that no generally accepted principles of such management have yet been formulated. Various methods of procedure have been adopted in different places, but rarely has it happened that any one of them received general approbation, or was adopted elsewhere, without more or less modification. In most cases the exercise of sound judgment is hampered by considerations of expediency, and hence temporary or superficial plans of financial management are in vogue which must, sooner or later, be materially amended.

Much confusion is also caused by the careless use of terms in the

* Condensed from annual report of the Executive Board of the city of Rochester, N. Y., just issued.

discussion of the subject, as well as in the classification of the various items of income or expense. That which is treated as a maintenance or repair account in one city will often be charged to construction in another place, and in some cases the cost will be divided arbitrarily between the two accounts. Again, a distinction is sometimes made between the maintenance and the repair accounts, and when renewals or improvements of any part of the works are made, a separate account may be opened. It is therefore necessary to examine the financial statements relating to the water-works of different cities with the utmost care, in order to avoid serious error in making comparisons.

Expenses.—In dealing with the annual expenses or charges against a water-works system, the following items are to be taken into consideration:

1. The interest on the bonded debt incurred for construction.
2. A yearly payment into a sinking fund for the ultimate liquidation of the bonded debt.
3. A yearly payment into a fund for the periodical renewal of the perishable parts of the works.
4. The yearly operating expenses, including ordinary repairs and minor betterments.
5. The average cost of the usual yearly extensions or improvements of the distributing system.
6. A yearly contribution to a fund for the payment of anticipated future extensions of, or additions to, the supply system.
7. The interest on all capital expended for construction over and above the bonded debt.
8. A profit on the investment in addition to the preceding items.

In the case of successful private corporations, all of these items are taken into account, directly or indirectly, in fixing the rates charged for the service, goods or product, and it is frequently claimed that the same practice should be followed in the case of municipal water-works. Careful reflection, however, will lead to the conclusion that such a course is generally inexpedient, for the reason that a service undertaken by a community for its own exclusive benefit, and through its own government, is essentially a co-operative or mutual enterprise, the product of which is expected to be sold at cost to the participants; also, because it is manifestly absurd to demand that one branch of the municipal service shall yield a profit in order that the work involved in another department may ostensibly be performed for less than its true cost.

Strictly considered, the expenses of each department of the city's government should be tabulated separately, and the proper value of any service rendered, or materials furnished, by one department to another, should be duly credited and charged in the respective accounts. By this means alone will the real cost of any department, as well as the value of any service rendered by it, become known; and whenever it may be deemed expedient to make the revenue of such department large enough to yield a profit or surplus over its legitimate expenses, the fact should be distinctly announced and the reasons therefor intelligently explained. Under ordinary conditions, however, it seldom happens that a community deems it proper to make an appreciable profit from any service rendered to the citizens, and hence this item may at once be eliminated.

It is also very unusual for communities to demand from citizens payment for interest on past cash expenditures for the construction of public works, or to require of them annual contributions for the creation of a fund which is to be

expended at some distant future time for building prospective new works. The principles here involved are, on the one hand, that an adequate benefit has been derived from past payments, and on the other hand, that there is no obligation on the present generation to provide for remote future demands. No extended argument in support of these two principles appears to be necessary, it being understood that the future demands mentioned relate to entirely new works instead of to the proper maintenance of the existing ones; and hence the sixth and seventh items in the foregoing list may fairly be omitted.

With reference to the fifth item, which is a provision for the usual yearly extensions and improvements of the system of distributing pipes, in order that the service may keep pace with the ordinary increase of population and development of urban territory, it may strongly be urged that inasmuch as such increase is often quite variable, no definite limit to the annual provision can be assigned, and that the required sums for this purpose shall be fixed each year in proportion to the necessities. By this method the annual extensions of the pipe system will properly come under the head of construction, and be paid for by general taxation, as in the past. It must also be borne in mind that all such extensions are presumed to involve immediate benefits fully commensurate with the outlay, and that the tax on the additional valuation of property ensuing therefrom will ultimately repay the investment. The fifth item may, therefore, likewise be omitted from the list of charges against the works.

We have accordingly left of the list only the first four items of expense, which should fairly be met by the revenue derived from the works, viz.: The interest on the bonded debt, the sinking fund provision for the ultimate liquidation of said debt, the depreciation fund provision for the periodical renewal of the perishable parts of the works, and the annual operating expenses. Of these, the second and third are frequently combined into a single item, and may form a large or small percentage of the total yearly cost, depending upon the proportion of the aggregate amount which is left to posterity to pay. With regard to the first and fourth items, it is obvious that they should be paid in full by the existing inhabitants, and that the financial burden of the next generation should not be increased by any portion of these expenses.

Concerning the provision for sinking and depreciation funds, a considerable diversity of practice is found. In some cities it has been assumed that the present generation which incurred a certain bonded debt for a water-works system, should provide for its payment in full, besides leaving an adequate surplus for the renewal of the perishable parts of the system, so that the succeeding generation will inherit the works entirely free from debt and with its perishable parts renewed. In other places, however, this plan is regarded as much too generous, and provision is made only for maintaining the works in good order, so that posterity shall not have on its hands a worn-out or greatly depreciated plant, in addition to the original debt. A third plan is for the present generation to provide for the payment of so much of the bonded debt as relates to the perishable

parts of the works, leaving the remainder to be taken care of by posterity, and also to provide for the proper maintenance of the plant so as to leave it in good condition.

From the meager data available it seems that the usual practice in American cities has been to provide only for a general fund which may be used at its maturity, either for renewing a part of the works, or for paying off a portion of the bonded debt, but which is not sufficient for both purposes. The object has been merely to keep the finances of the works in tolerable equilibrium from time to time, so as to prevent the present generation from imposing undue liabilities upon its successor, but without leaving to it very good assets, or works from which it will derive much benefit except at the expense of more or less reconstruction. By this plan the works never become free from debt, but if they are maintained in good order, value may be equal to the bonded liability. This condition is essential to solvency, and is accordingly the lowest limit in the financial scale to which the works should be allowed to fall.

A somewhat safer plan to follow is the third one indicated above, by which provision is made not only for the renewal of the perishable parts of the works, but also for the extinction of the original cost of these parts. The plant will thereby be turned over to posterity partially paid for and in good condition, or with the means for putting it into such condition. To the extent of their capacity the works will then serve the future as they did the past or present, and it is therefore proper that the future should bear at least the cost of the permanent portions as well as the subsequent renewals. The burden is thus divided between two or more generations, each paying a reasonable share of the total original cost; and at the same time, some consideration is expressed for the greater expenditures of the future, which will assuredly come with increase of population and the constant demands for the improvement of the general welfare.

In relation to the "life" of the perishable parts of a water-works system little definite knowledge is yet available. Pipes and their appurtenances may last for from 20 to 50 years, according to circumstances, while steam boilers and pumping machinery may have to be renewed more frequently; but in general it may be assumed that, with the changes rendered necessary in a growing city, by the gradual development of residential into commercial districts, the costs involved in maintaining a proper standard of efficiency for the works are practically equivalent to a renewal of the perishable parts of a plant every 30 years. The same period of time has also been generally adopted as the duration of the sinking fund for liquidating the bonded debt of the works; and until better statistics have been gathered, we may accordingly adopt this limit for the maturity of both funds.

As the gradual formation of a fund by a series of annual payments is generally understood only in a vague manner outside of financial circles, a few words on this subject may be permitted. Each annual payment is to be invested so as to yield a good rate of interest, which is to be added to the said payment or principal every succeeding year, the interest for such year then being computed on the sum. We thus have compound interest on each of the annual payments, and the sum of these payments, with

accrued compound interest, constitutes the fund. Expressed in mathematical terms, the annual payment (s) which must be made during a period of (n) years, and which will be invested at compound interest at the rate of (r) per cent., in order to produce a certain ultimate principal or sum (p), is found from the equation.

$$s = \frac{r}{(100 + r)\left\{\left(1 + \frac{r}{100}\right)^{n} - 1\right\}} \cdot p$$

Assuming n = 30 and r = 3, we have from this expression: s = 0.02041 p; or, in other words, the annual payment (s) made during a period of 30 years and bearing compound interest at 3 per cent., must be about one-fiftieth, or 2 per cent., of the ultimate required sum (p). In like manner, if compound interest at 3½ per cent. could be secured on the annual payments, the amount of each such payment would be 1.872 per cent. of the sum (p); and if compound interest at 4 per cent. were obtained, the annual payments would become 1.715 per cent. of said sum. In general, therefore, it may be said that the yearly charge against the works for the production of a fund sufficient to pay off the original cost of the perishable parts, or to renew the same, after a period of 30 years, should be about 2 per cent. of such cost; and if both items are considered, the yearly charge should be 4 per cent. of said cost.

The foregoing analysis of the problem thus leads to the conclusion that the proper annual charges or expenses of a municipal water-works system should embrace the interest on the bonded debt for construction, a contribution to a thirty-year sinking and renewal fund for the perishable parts of the plant alone, and the operating expenses, including ordinary repairs and betterments. All extensions and material improvements of the system should be regarded as new construction work, to be paid for by general taxation; but a certain percentage of such cost, sufficient to furnish the amount necessary for renewal, as aforesaid, should be charged to the works, since it may fairly be presumed that a corresponding revenue will be derived from such extensions. On the other hand, the works should not be charged with interest on past cash payments for extensions, or for a sinking fund for the same, or for a profit.

Revenue. — Having considered the proper yearly charges or expenses of a municipal water-works, and knowing that the system should have a revenue equal in amount to such expenses, it next becomes of importance to ascertain how this revenue should be obtained. Obviously the entire sum must be paid by the citizens, either by assessment upon all taxable property, or by assessment upon the real estate alone which is served, or by direct charge for the quantity of water actually or presumably used in the premises of each consumer, or by a combination of these charges. The latter method is commonly adopted, inasmuch as a considerable percentage of the water is used for a great variety of general public purposes, and its value should accordingly be paid by a uniformly distributed charge upon all taxable property. In addition to this sum, however, a certain proportion of the total yearly cost should also be paid by general taxation, since a large share of the expense of construction and maintenance is due to the necessary enlargement of the capacity of the pipes, reservoirs, pumping machin-

ery, etc., for the suppression of fires, and to provide for the future growth of the community.

In regard to the proportion of the total yearly cost which should be paid by general taxation on account of the initial enlargement of the works for fire, public and future purposes, much diversity of opinion exists. Some contend that this charge should be borne entirely by the present consumers, while others claim that it should be paid by assessment upon all taxable property, in order to make the water rates as low as possible. By the latter class of advocates, a sharp distinction is made between taxpayers and water consumers, or, as it may otherwise be expressed, between the taxable property of a community and the individuals, corporations or civic departments which consume the water; and they insist that inasmuch as the said cost was incurred for the general public benefit, instead of for individuals, all taxable property should be assessed therefor uniformly, exactly as in the case of the public school, fire and police services. This argument is a very strong one, and appears to have been generally recognized in one form or another, such as the payment of a rental for fire hydrants to private water supply companies, or the payment of a portion of the yearly interest account where the works are owned by the community. It may therefore be assumed that public opinion is generally in favor of the proposition that some part of the yearly cost of the works should be paid by uniform assessment upon all taxable property.

It is obvious that the provision for adequate fire protection and future growth of the community materially increases the cost of construction over that which would be required to furnish only the quantity of water needed for domestic and manufacturing purposes. While the aggregate amount of water used per year for suppressing fires may be but a small percentage of the total supply, yet it must be delivered in large volume during short periods of time and without causing appreciable interference with all other uses. As a consequence, nearly every part of the work must have considerably greater capacity than is required for the service of individual consumers alone; and the same is manifestly true when provision is made for future growth. A number of estimates of the increased cost of construction to afford fire protection alone have been made by several experienced engineers, from which it appears that such increase is at least 60 per cent., or that over one-third of the entire cost is expended for meeting this requirement; and it may also be added that a recent analysis of the cost of our own works has led to practically the same conclusion.

With reference to the provision for future growth of the community, the proportional costs of construction vary from year to year, as the expectations of increase are being realized. Ordinarily, the main features of the water-works of a large city are designed so as to require no enlargement for a period of from 20 to 40 years, during which time the population will probably be doubled. The cost of this provision may, in general, be taken at fully 30 per cent. of the total original expense, or about the same as for the fire protection; and as it was incurred essentially with the purpose of attracting other people to become permanent residents of the city and increase its wealth, the investment partakes of

the nature of public speculation. In this view of the case, it is proper that the yearly cost of such investment should be borne, in part at least, by the entire taxable property. By the increase of population, however, the yearly consumption of water gradually becomes larger, and if the price is based on the quantity used, the annual contribution to the necessary revenue from general taxation will gradually diminish, and will cease entirely in this respect after the original provision for future growth is exhausted.

In opposition to this method of securing a portion of the revenue, it may be urged that the entire yearly cost of the said provision should be included in the water rents, on the ground that the taxable property of the community is sufficiently burdened with other charges previously mentioned. If this plan were adopted, the rates for the use of the water would necessarily be very high in the outset, but might be reduced from year to year as the consumption increases. Such a policy is, however, generally regarded as unwise in commercial circles, since great stress is laid upon low and unfluctuating water rates, whereby a strong inducement is offered to the establishment of new industrial enterprises, which will cause a far more rapid increase of the wealth of the city than can possibly ensue from the slower growth of the residential population alone.

When it is argued in such circles that a somewhat higher general tax rate must make up the deficiency in revenue which results from a ow price for the water, the answer is promptly given that a moderate addition to the general taxes is so widely distributed as to be practically inappreciable to the great majority of tax-payers, and that the increase in the value of real estate, due to the presence of such industries in the community, abundantly compensates the owners thereof for their slightly higher taxation; whereas, if the same amount were to be added in the water rents, the burden would fall heavily upon the proprietors of industrial establishments, on whose enterprise the prosperity of the public is principally dependent.

There is, however, another excellent reason for making a division of the financial burden between persons and property which is not often considered. This is the average annual saving in the amount of fire insurance premiums paid by the property-owners, after the introduction of an efficient system of water-works, over that which would be required if the city had no public water supply; and as the loss by fires is never fully compensated by the insurance, there is also the average annual saving in such uncompensated loss to the community in consequence of the operation of the water-works. Even a very superficial investigation of the statistics relating to insurance and fire losses in large cities brings to light the fact that these two savings are of great magnitude, and a close analysis demonstrates that they are often larger than the annual interest charges on the entire cost of the works. Manifestly the benefit thus gained applies mainly to property, although some advantage also results to persons by reason of the greater chance for continuous employment in a city where fires are quickly suppressed.

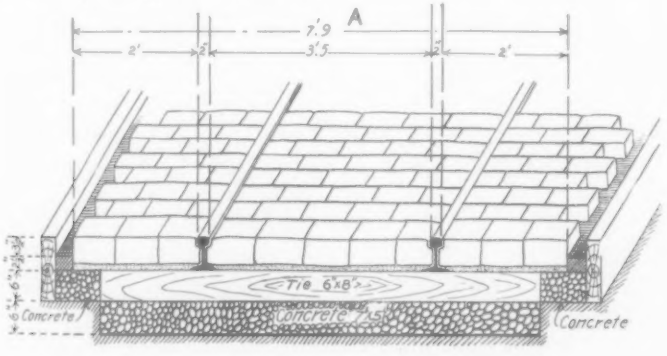
These considerations also lead to the further fact that the requirements of modern civilization render the development of a large city, and the resulting great increase in the

value of real estate, impossible without an adequate system of water supply or fire protection. In nearly all cases, the appreciation in the value of such property, soon after the introduction of water-works, becomes much larger than the cost of the plant, and its market price continues to advance steadily with the subsequent growth of population. This rise in value and the reduction in rates of insurance and fire loss are clearly benefits which accrue only to property, as opposed to persons or water consumers, and it therefore follows that an equitable division of the yearly charges should be made between these two elements.

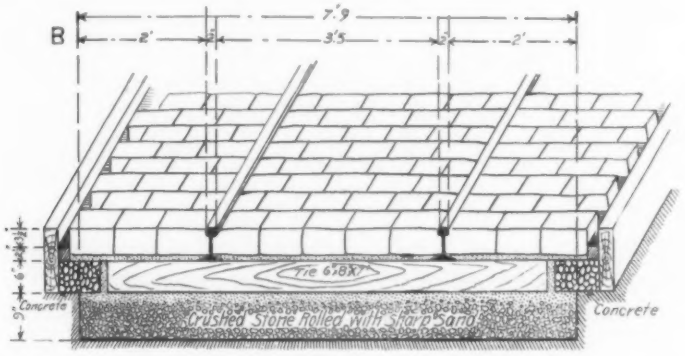
While much more might be said upon the question, it seems to be generally conceded that the water rates of a large city should be as low as possible, and that a considerable proportion of the annual expenses of the works should be paid by general taxation. From the foregoing we have seen that, on an average, fully one-third of the yearly interest on the bonded debt for a future water supply is incurred for fire protection, and about the same amount for the provision for future growth. The whole of the former and perhaps about one-half of the latter should fairly be paid by general taxation, and in addition thereto compensation should also be allowed at the established rates for the water which is used for general public purposes; the remainder of the revenue required to pay the annual expenses may then be obtained by charges for the use of the water by all classes of private consumers. Under such conditions, and with the understanding that the interest account includes an adequate sum for sinking fund and depreciation, the works may be regarded as conducted on proper business principles, without discrimination in favor of either tax-payer or consumer.

COST OF TRACK CONSTRUCTION ON PAVED STREETS.

When the Denver Consolidated Tramway Company decided upon the reconstruction of its tracks, the consulting engineer for the company, John A. Beeler, prepared specifications for a number of methods of construction which, with the estimates of the cost, were submitted to the directors. The estimates of cost are per mile of single track including pavement 7 ft. 6 in. wide. Illustrations of the different methods, with estimate of cost, are given below:

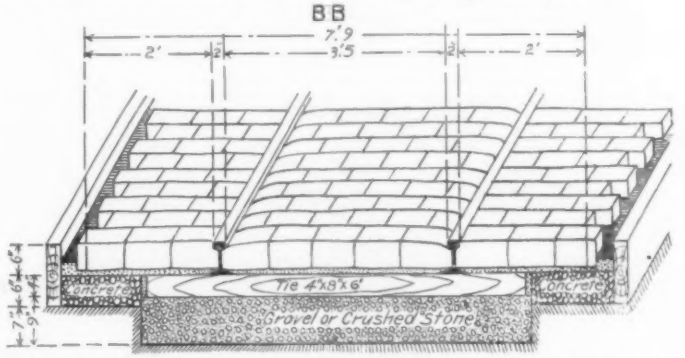


Section A. 72-lb. rail—plastic bonds—hewn red spruce ties, 24 in. center to center—hydraulic concrete foundation 6 in. deep under ties and between ties—basalt block pavement, $26,940.

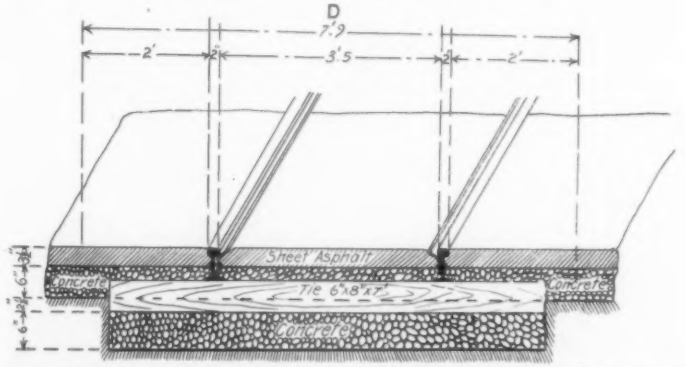


Section B. 72-lb. rail—plastic bonds—hewn red spruce ties—gravel foundation 9 in. deep under ties—hydraulic cement concrete 6 in. deep under blocks between ties, and at ends of ties—basalt block pavement, $23,000.

Same section with gravel under and between ties and hydraulic cement concrete under blocks at ends of ties only, $21,570.

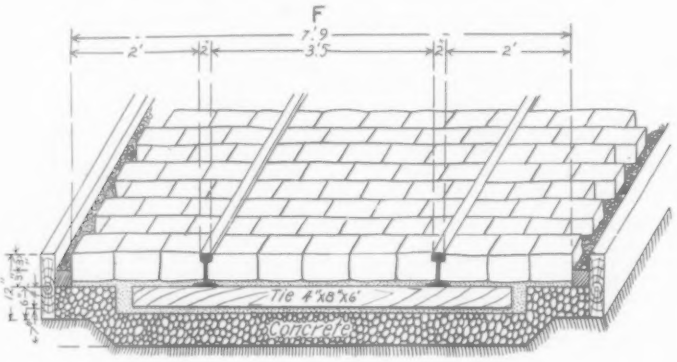


Section BB. 72-lb. rail—plastic bonds—creosoted ties, 4 in. x 8 in. x 6 ft. 24 in. center to center—gravel 9 in. deep under ties and between ties—hydraulic cement concrete foundation for pavement 6 in. deep beyond the ends of ties—basalt block pavement, $21,500.

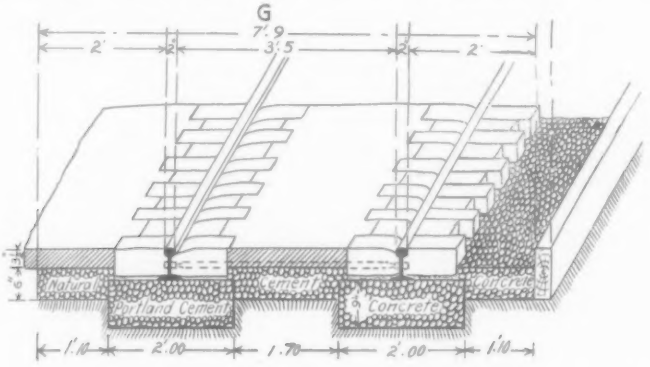


Similar to Section D. 72-lb. rail—plastic bonds—hewn red spruce

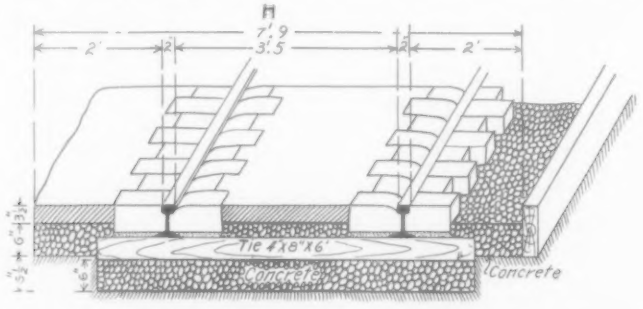
ties, 24 in. center to center—hydraulic cement concrete 6 in. deep under ties—asphalt pavement with basalt block toothing (instead of steel flange as shown), $24,700.



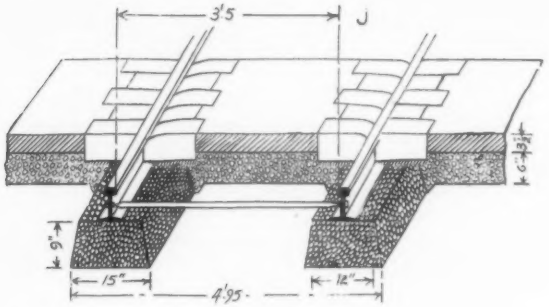
Section F. 72-lb. rail—plastic bonds—creosoted ties 4 in. x 8 in. x 6 ft., 24 in. center to center—hydraulic cement concrete foundation under ties and at ends of ties—1-in. sand cushion tamped under ties—gravel between ties—basalt block pavement, $24,130.



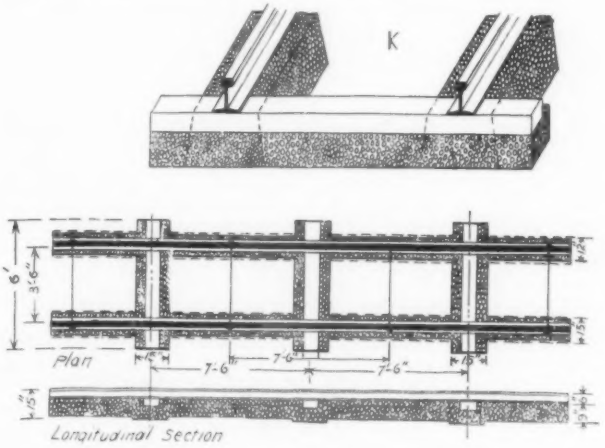
Section G. 72-lb. rail—plastic bonds—four creosoted ties, 5 in. x 8 in. x 5 ft. 6 in., and four tie rods to each rail—Portland cement concrete under rails—asphalt pavement with stone toothing, $25,360.



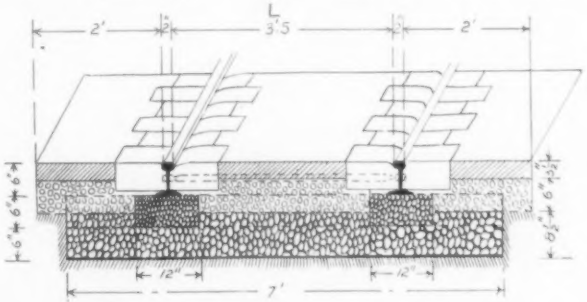
Section H. 72 lb. rail—plastic bonds—creosoted ties, 4 in. x 8 in. x 5 ft. 6 in., 24 in. center to center—hydraulic cement concrete 6 in. deep under ties—asphalt pavement with stone toothing, $23,950.



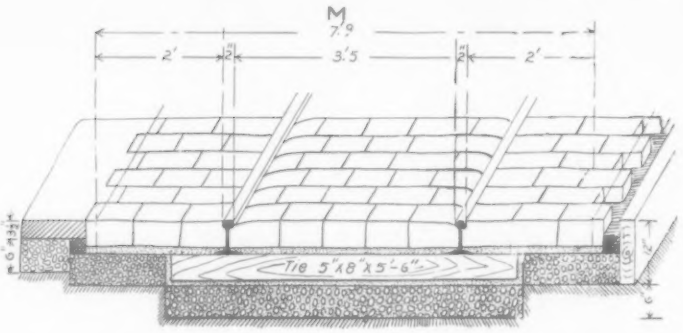
Section J. 72-lb. rail—plastic bonds—all concrete construction—Portland cement concrete stringers under rails—tie rods 5 ft. apart—asphalt pavement with stone block toothing, $25,750.



Section K. 72-lb. rail—plastic bonds—four creosoted ties, 4 in. x 8 in. x 6 ft., and four tie rods to each rail—Portland cement concrete strips under rails—asphalt pavement with stone block toothing, $23,300.



Section L. 72-lb. rail—plastic bonds—hewn red spruce ties, 6 in. x 8 in. x 7 ft., 36 in. center to center—tie rods 6 ft. apart—hydraulic cement concrete foundations 6 in. deep under ties—Portland cement concrete under rail between ties—asphalt pavement with stone block toothing, $25,340.



Section M. 72-lb. rail—plastic bonds—creosoted ties, 5 in. x 8 in. x 5 ft. 6 in., 24 in. center to center—hydraulic cement concrete foundation 6 in. deep under ties and under pavement beyond ends of ties—concrete between ties—1-in. sand cushion tamped under ties—basalt block pavement, $26,280.

WATER EVAPORATION EXPERIMENTS.

Experiments for determining the amount of evaporation from the water surface of Mt. Hope reservoir at Rochester, N. Y., have been conducted since 1891, and the methods followed are presented by Mr. Emil Kuichling, the chief engineer of the Rochester water-works, as follows:

The apparatus consists essentially of a small timber raft, or floating platform, and two indurated fiber tubs, about 15 inches in diameter and 5.75 inches deep, in each of which an accurately measured volume of water taken directly from the reservoir is placed. During the open season one of these tubs is freely exposed on the raft, while the other is floated in a large square opening in the middle of the raft and held in place by cords. The deep timbers which surround this central opening are almost fully submerged, and thus prevent any appreciable agitation of the inclosed water and tub. At the end of every twenty-four hours the water left in each tub is carefully measured, and the tubs are then refilled with fresh water. In case of rainfall the depth of the precipitation is determined from a 9-inch rain gauge immediately after its cessation, and proper allowance therefor is made in computing the loss by evaporation.

The records thus obtained for several years showed the loss which occurred from April to November, and also allowed a comparison to be made between the results from the exposed and the floating tub. It was, however, desirable to ascertain the loss during the winter months as well, and in November, 1895, the apparatus was slightly modified for cold weather use by placing a 13-inch tub within one of somewhat larger diameter, so as to leave a small annular space around the outside of the former and also a space under its bottom. A flanged collar placed around the top of the inner tub prevents snow or rain from entering the spaces mentioned, and also checks any appreciable circulation of air therein. The inner tub can accordingly

be lifted out from the other one at any time when the latter may be frozen firmly into the ice.

To prevent the inner tub from being burst or damaged by the freezing of the contained water, a solid wooden cone, about 5 inches in diameter at the base and 5¾ inches high, loaded with lead so as to sink, was placed upright in the middle of the tub for the purpose of allowing the ice to rise upon its surface while in process of forming. By this simple expedient and the greasing of the sides, all injury to the tubs was obviated. The determintion of the loss by evaporation is made by periodically weighing the inner tub with its contents upon a sensitive platform scale, due allowance being made in the computations for the slight reduction of area of water or ice surface caused by the projecting part of the wooden cone, as well as for rain and snow.

THE QUESTION DEPARTMENT.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

HOW TO RAISE CAPITAL FOR WATER-WORKS.

Will you kindly give me any information you may have (1) as to the best manner in which to raise the capital necessary to start a small water-works? (2) What are the laws governing incorporation, issuing of bonds, etc.? (3) Are bonds of small water-works considered a safe investment? The outlay is to be about $20,000.

E. L. G., Baltimore, Md.

1. For a small system of works, it is frequently possible to interest private capital directly, if a contract with the city or village for fire protection and contracts from a sufficient number of consumers can be obtained beforehand, or are reasonably certain. It will probably be easiest to manage the financial operations if a company is formed with a sufficient amount of capital stock authorized to handle the business, and authority to issue a limited amount of bonds. If the local business men are interested in the establishment of the works a fair share of the stock or bonds, or both, can be placed with them. There are many water-works contractors who will take part or all of their pay in the securities of the company if they are satisfied with them, or who have connections through which they can place the securities. For a small works the nearer home the money can be raised, and the closer the stock and bond holders are interested in the development of the plant, the better will be the results.

2. The laws governing incorporation vary much in the different states. If the company is local it should be incorporated in its own state.

3. The security of water-works investments varies, as does that of any other class of investments, with the honesty and ability of the management, the nature and permanency of its contracts, its ability to collect its debts, etc. If the company has a franchise, which gives it valuable rights, and has a contract with the city or village, which can be enforced, which will raise sufficient money to pay all, or nearly all, the interest on the bonds, and which can be assigned for that purpose, the bonds can be placed readily at, or not far from, par. Every doubt thrown on the legality of any procedure, or the validity of any contract, rapidly

diminishes the value of the investment and makes the placing of the securities more difficult. Too many small towns give their franchises directly, or indirectly, to persons from outside, whose only purpose is to secure a valuable piece of paper, which can be traded with. The franchise is then liable to become the property of unscrupulous parties, whose only purpose is, in their turn, to get as much money for as little work as possible, finding their opportunity in the ignorance of the ordinary council, or board of trustees on such matters, and in the reluctance of such bodies to expend a little money for honest and expert engineering, and legal assistance in preparing the franchise and contract, inspecting the construction of works, and testing their compliance with the terms of the agreements. The experience of one town seems to have little effect upon other towns, doubtless because the American method of city government, by frequent changes in all departments of the town government, keeps a new supply of ignorance of municipal affairs always on hand.

FIRE HYDRANT RENTALS IN AMERICAN CITIES.

Our board of water-works trustees would like some information in regard to the price per fire hydrant from different towns and cities, both private and municipal plans, paid per year. *L. C. Fox, Supt. Van Wert, O., Water-Works.*

Some data on this question were published in the January, February, April and August numbers and we have some more for future publication. From all these data, which were collected by MUNICIPAL ENGINEERING for the year 1895, from water companies in reply to a special inquiry, the following have been selected as bearing upon the question, and have been arranged in tabular form.

The cities in the table have been arranged in the order of the number of hydrants, and vary in population from Milwaukee with 250,000 to Hyde Park, Mass., with 10,000. Thirty-three of the cities have private water companies and twenty-two of them have municipal ownership. In a few instances the payment by the city to the water company or water department is a lump sum instead of depending upon the number of hydrants, in which cases it usually includes all the water used for public purposes. Assuming, as approximately correct, that the rental per hydrant can be determined by dividing the lump sum by the number of hydrants, and determining the average hydrant rental for those places which report several rates, we can determine the average hydrant rental for the cities given in the table. We thus determine the average for the 33 private works to be $47 a year and for the 22 public works to be $31 a year. In the case of the municipal works there is a slight indication that the rental per hydrant increases for the smaller places, but in the case of private ownership there is no such tendency visible. The averages may, therefore, be applied to cities of all sizes without discrimination. The difference in favor of the city on account of municipal ownership is very marked. There are many factors which bring this about. Perhaps the most important is the distribution of the dividends to the consumers in the shape of reduced water rates, in the case of municipal ownership. Many cities do not keep their accounts in such shape that the portion of revenues directly chargeable to hydrant rentals can be determined. Only the twenty-

TABLE OF CHARGES FOR FIRE SERVICE.

CITY.	Ownership.	Population.	Miles of pipe.	No. hydrants.	Hydrant rental, per year.
Denver, Col...	Private	150,000	110	2566	$35
Milw'kee, Wis	City	250.000	296	2174	20
Providence, R.I	City	157,000	275	1700	30
Rochester, N.Y	City	166,000	265	2578	100.000 for all public purposes.
Omaha, Neb...	Private	140,000	200	250 31 1112	84 10 60
Lowell, Mass..	City	90 000	185	1039	12
Pawtucket R. I.	City	65,000	128	916	20
Syracuse, N. Y.	City	120,000	127	2073	40.000 for all.
Springf'd, Mass	City	52 000	123	793	20
Newton, Mass..	City	28,000	120	805	20
Johnstown, Pa	Private	35,000	88	140	37 50
Hartford, Conn	City	60.000	85	621	20
Manch'st'r, N H	City	55.000	85	672	25
Des Moines, Ia	Private	65,000	82	910	350 per mile.
Elizabeth, N.J.	Private	40,000	75	260	25
Memphis, Tenn	Private	80,000	70	400	80 to 50
Birm'gham, Al	Private	50.000	70	244	55
Utica, N. Y....	Private	44,000	61	362	24.000 for all, 1890
Concord, N. H.	City	17,000	56	243	6.000 for all.
Nashau, N. H..	Private	25,000	55	225	30
Ft. Worth, Tex.	City	35,000	53	100 365	100. 50.
Pittsfield, Mass	City	21,000	52	175	30.
Northhamp'on, Mass.....	City	17,000	51	244	2,000 for all public purposes.
Waco, Tex.....	Private	25,000	47	218	40, $35 and 30.
Woonsocket, R. I.....	City	28.000	46	489	30.
Elmira, N. Y...	Private	35,000	46	346	13.000 for all public purposes.
Akron, Ohio...	Private	35,000	45	282	40.
Kingston, N.Y.	City	23,000	42	332	30.
Montgomery, Ala.....	Private	30,000	40	250	55.
Oshkosh, Wis..	Private	28,000	40	363	20,500 for all public purposes.
Dubuque, Ia...	Private	40 000	40	123	50.
Topeka, Kan...	Private	38.000	38	320	46.66 and 150.
Burlington, Vt.	City	17,000	36	195	20.
Chicopee, Mass	City	17,000	34	142	20.
Quincy, Ill....	Private	40,000	34	193	9,000 for all city purposes.
Hyde Park, Mass	Private	10,000	32	175	31.
Cedar Rapids, Iowa	Private	22,000	32	202	50.
Newburyport, Mass.....	City	14.700	30	174	40.
Eau Claire, Wis	Private	18,000	30	346	54 and $44.
Clinton, Mass..	City	11.500	29	159	30
Hastings, Neb	City	12.000	28	123	60
L'v'worth, Kan	Private	23,900	27	133	75
Newark, Ohio	Private	17,000	27	.00 66	48 45
Streator, Ill....	Private	16,000	26	228	45 and 35
Kan. City, Kan.	Private	42.000	25	300	50
Ottumwa, Iowa	Private	20,000	25	152	60
Plainfield, N. J.	Private	20 000	24	300	15
Alpena, Mich..	Private	13,000	22	80 70	50 40
Mahanoy, Pa..	Private	14.500	20	42	10
Schn'ct'dy, N.Y	City	20.000	20	188	104
Columbus, Ga..	Private	30,000	20	142	80 and 75
Lexington, Ky.	Private	26,000	18	263	50
Elkhart, Ind...	Private	15,000	16	155	75, 50 and 40
Atchison, Kan.	Private	15,000	13	100	60
Superior, Wis.	Private	25,000	10	650	50

two given in the table can be selected from the large number of cities whose data in general are at hand. Some of these cities would tend to increase the average hydrant rental, but more would tend to decrease it. There has been no selection of cities. All from which the data desired could be obtained have been given.

METER RATES FOR WATER IN DETROIT.

Please state correct meter rates of Detroit. *L. M. Case,*

Gen. Supt. Water-Works, Detroit, Mich.

In Mr. Dabney H. Maury's compilation of water rates of various cities, on page 134 of the September number of MUNICIPAL ENGINEERING, the old rates of Detroit, were given. Beginning with July 1, 1897, a new schedule went into force, and the statement on page 134 should now read: Minimum meter rates, 50 cents a month, or $6 a year; first 5,000 gallons, 10 cents per 1,000; next, 10,000 gallons, 5 cents, all over 15,000, 1¾ cents. The rates are charged up monthly.

WATER RATES BASED ON HORSE POWER OF ENGINE.

Do you know of any rule by which a man not an engineer can tell what horse power is used in running an engine, and what amount of water will be consumed per horse power per hour? Our water rate is per horse power for ten hour's run.

J. J. Davenport,

President Sturgis (S. Dakota) Water Co.

The horse power actually developed in the cylinders of an engine can only be determined with any degree of accuracy from indicator diagrams and number of strokes. It is a difficult and laborious operation to obtain the exact horse power developed in an engine running with variable load. For the purposes of assessing the water rate it should be sufficient to estimate the amount of water used on

the basis of the rated horse power of the engine. As stated in this department on page 35 of the July number, the ordinary rule for rating boilers and engines is 30 pounds of water, evaporated, per horse power per hour. A ten-horse power engine would use 36 gallons an hour. If the engine is of an economical design, it will use less than this amount, but allowance for water used in other ways about the machinery, and for leakage of water and steam, including time when engine is not actually running, will make this estimate fair. Also, if the engine is not running at its rated capacity the amount of water will be less, but if it is running above its rated capacity the amount will be greater. Also, if the engine is not in good repair, or is not well designed, the amount of water used and lost by leakage will be increased. On the whole, therefore, the best that can be done, practically, under your water rate is to estimate the water used at 30 pounds per rated horse power of engine per hour run. A meter would make known the exact amount of water used, and would be the best solution of your difficulty.

[By J. W. Howard, B. L., C. E., for MUNICIPAL ENGINEERING.]

TYPHOID FEVER CAUSED MORE BY IMPURE WATER THAN UNCLEAN STREETS.

Is typhoid fever in our cities caused more by bad water than by the failure to properly clean the streets and alleys?

R. W. Grover, Albany, N. Y.

A careful examination of statistics from various cities in Europe and America indicate clearly that an impure water supply is the greatest known cause of typhoid fever. Unclean streets and dirty alleys may generate some cases of typhoid fever, but the disease germs which are developed and spread by means of such streets and alleys are those of other diseases almost as much to be dreaded as typhoid fever. The most recent example of the great and immediate decrease in deaths from typhoid fever, and of the disease itself, is found in Jersey City, N. J. That city was using water from the Passaic river, until during the last part of 1895, when arrangements were completed by which pure water from the mountains at Pequannock was mixed with the impure Passaic water by pumping less of the Passaic and introducing an increasing amount of the pure water into the same acqueduct which supplied that city. During January, 1896, the proportions of pure and impure water mixed were 28 and 72 per cent. respectively, resulting in 28 deaths during that month. During February, the proportions were, 40 pure, 60 impure, deaths 30; March, 43 pure, 57 impure, deaths 16; April, 58 per cent. pure with 42 per cent. impure water reduced the number of deaths to 9 during that month. During May of the same year 50 per cent. pure with 50 per cent. impure caused 6 deaths; June, 80 per cent. pure, 20 per cent. impure, 7 deaths; July, 80 per cent. pure, 20 per cent. impure, 3 deaths; August, 76 per cent. pure, 24 per cent. impure, 3 deaths; September, 70 per cent. pure, 30 per cent. impure, 3 deaths; October, 89 per cent. pure, 11 impure, 4 deaths; November, 100 pure with no impure Passaic water, resulted in but one death in that month. Subsequent records in that city show but little trouble from typhoid fever from the pure water now used.

Newark, N. J., had a similar but

more striking experience with this fever, up to within about five years, when the pure water supply suddenly reduced the number of deaths to less than two per cent. suffered by that city when it used impure river water.

Chicago is a noted example of the terrible scourge of typhoid fever due to the sewage flowing into the lake and the lake water being pumped back into the city for drinking and cooking purposes. The reports of the health officer there show that typhoid fever killed more than three per cent. of the total persons dying from all causes during 1896. It has been pointed out that the legal value of the human life thus sacrificed in one year was $3,750,000. If the medical treatment is added, we would have a sum exceeding $5,000,000. It is no wonder that a drainage canal, costing what it may, will be economical in Chicago, if thereby the lake water can be freed from typhoid germs.

STONES SUITABLE FOR STREET PAVING.

Are Colorado sandstone, Sioux Falls granite and Medina sandstone good for street paving? *Pittsburg Inspector.*

If well selected and properly cut they are good for pavements. Maine granite is not all good for pavements. Some of it makes excellent paving blocks. It is neither too brittle nor too soft. It wears evenly because its texture is homeogeneous . It can be cut with little trouble into uniform blocks. Colorado sandstone, such as is used for paving blocks, is one of the very few sandstones which are hard. The impression is that it is very difficult to manufacture from Colorado sandstone squarely cut blocks wi h even surfaces. Medina sandstone can be cut and finished into even blocks, but it sometimes lacks hardness. If the cost of freight from Maine is considered to cities within easy reach of the other materials, it is cheaper to use the others, even if some make a little rougher pavement than the Maine granite, or a pavement not quite so durable. Durability is a question of repairs, and if additional blocks can be had at a little expense, and if repairs are made promptly, softer blocks prove satisfactory.

Full information is not at hand concerning Sioux Falls granite, further than that it makes an excellent finish when crushed and spread upon macadam or telford roadways. Some reader may be able to contribute the desired information concerning Sioux Falls granite.

DEATH-RATE OF NEW YORK AND LARGE EUROPEAN CITIES.

Is the death-rate of New York greater than that of London, Berlin and Paris? *Dr. M. A. S., New York.*

It is greater than the three cities named, as indicated in the following table taken from official reports obtained from Europe and New York by MUNICIPAL ENGINEERING MAGAZINE. The table shows the number of deaths per thousand inhabitants per year. It can also be regarded as a fair average of the last three years:

Berlin	19.6
Amsterdam	20.0
London	20.6
Rome	21.2
Paris	22.4
New York	23.1
Vienna	24.3
Munich	26.0
Dublin	29.3
St. Petersburg	30.0

In the interest of good, impermeable pavements and good street cleaning, it is pleasing to note that the death-rate of New York city, since 1891, has steadily improved

from 26 to 23 per 1,000 inhabitants. Through the reform and business-like administration, because of the new pavements and the consequent cleanliness, about 40,000 people are to-day among the living in New York city, who would have been among the dead, if the old high death-rate had been maintained by persisting in rough, permeable, germ-retaining pavements, difficult, if not impossible, to properly clean.

SAMPLE IMPORTED STONE BLOCK PAVEMENT, NEW YORK CITY.

What is the peculiar pavement of small stone blocks laid on West street, near Chambers street, New York city, between the two lines of tracks, but not where the horses nor the wagons travel? The size and kind of blocks seem different from the others on the street.

J. P. C., Hoboken, N. J.

A little less than a year ago some porphyry stone paving blocks were imported from Belgium. They were laid in the place you refer to on West street, but not upon the roadway to the right and left of the double line street-car tracks. They thus did not receive but a fraction of the heavy traffic along that street bordering the docks. It would have been better to have laid them across the entire width of the street for a shorter distance than the longer stretch between the lines of the street-car tracks. The blocks are made from the hard Belgium rock and cut with great precision. The size is smaller than the usual granite paving blocks used in New York city.

Another sample will probably be laid near the entrance to new piers 24 and 25 on the Hudson river side of New York city at the expense of the person who received, in July, permission from the board of dock commissioners to lay a sample of experimental porphyry at his own cost. There is no doubt as to the durability of the material and as to the excellent finish of the blocks. If laid closely together upon a proper concrete foundation they will make a durable surface. But being imported from Belgium and probably subject to duty, we doubt if they can compete with material which can probably be found equally as good in this country. Further experiments will be watched with much interest. If our best granite blocks were a little smaller, and made with such exact corners and face, excellent results would follow.

USE OF BINDER IN ASPHALT PAVEMENT.

Is binder or a coarse bituminous concrete used in most of the large cities of the east? Is it an experiment? Why is it used? I believe it is generally used, and makes the pavement more durable.

W. H. Worswick, Spokane, Wash.

It is not an experiment, and is required in almost all cities using asphalt pavements in the United States, except upon the Pacific coast. Its use prevents the asphalt wearing surface above it from slipping upon the concrete foundation below the binder. In the case of asphalt pavement laid over old stone or macadam pavements, the binder or bituminous concrete laid directly upon the old stone or macadam fills up depressions and gives a uniform and slightly elastic surface, upon which 1½ to 2 inches of asphalt pavement is laid. Experience has shown that for streets receiving pavement for the first time, no safer foundation can be laid than hydraulic cement concrete, which for heavy traffic is now made 5 inches thick, because of the binder of about 1½ inches, which is laid upon the concrete, the asphalt surface for heavy traffic being 2 inches. A less thickness of each is allowable for streets subjected to light traffic.

EXPANDED METAL IN CONCRETE FOUNDATION FOR PAVEMENTS.

Would expanded metal, or its equivalent, be valuable in concrete foundation? *X.*

As the writer of this question does not state in what city, or over what class of subsoil he would desire to use expanded metal in concrete, it is difficult to answer with precision whether a physical advantage would be gained or not. It is evident that he means to imply that the concrete would be strengthened by it. This would result if the expanded metal, or some strong close woven wire web or screen were embedded in the concrete, preferably near the bottom of the lower half, so that its resistance would be one of tension.

The principle of strengthening concretes by embedded metal devices is not new, and very often successful. The question of cost would be a local one, and whether or not the saving in thickness of concrete would counterbalance the expense of the metal much would depend upon the kind of paving material —asphalt, granite, brick or wood —which is to be laid upon the foundation, as to whether or not the embedded metal or web would be an advantage. If a hard unyielding soil is below the pavement, and properly consolidated, the use of expanded metal, or its equivalent, would be of no advantage, unless thereby the thickness could be very much reduced.

MATERIAL FOR CURB STONES.

Does granite make a better curb stone for streets than bluestone or sandstone? *A. C., Omaha, Neb.*

Granite is the best material from which to make curb stones, or what are known in some communities as edge stones. Many bluestones are unfit for curbing; nevertheless, with care, it is possible to pick out some bluestone and a few kinds of sandstone suitable for this use. The principal cost is generally transportation, and this often governs the selection of the material. It is more difficult to finish certain compact sandstones and bluestones to the same even surface as granite.

DIRECTION OF SIDES OF MANHOLE COVERS.

Should square manhole or stop-box covers on asphalt paved streets be set diagonally or not? *A. E. F.*

Upon granite and brick paved streets they should be set with the edges of the covers parallel to the joints of the pavement, but in asphalt pavements it is best to set such covers so that the sides are diagonal to the line of traffic along the street.

BY WAY OF COMMENT.

Compensation of Engineers.

An interesting table of the rates of compensation fixed for the ordinary grades of engineering work is given in the Question Department in this number of MUNICIPAL ENGINEERING. There is a difference between the terms "compensation of engineers" and "compensation for engineering works," which the general public is not usually able to see, not being well informed as to the desirability of having engineers to do engineering work, and measuring the value of engineers' services by the low standard set by non-professional men, and by some unprofessional engineers: This ignorance on the part of the public can only be removed by education, and engineers, by some sort of organization, can do more in this line than anyone else, for no one else is so directly interested. The purpose of the organization should really be to raise the ethical standard of the members of the profession, and make authoritative statement of it, the matter of proper compensation being rather a matter of discussion and general agreement than one requiring a fixed standard of prices. There are at least two grades of work included in the engineer's field, one the mechanical part, which may include most of the work of surveying, draughting and computation, and is allied to the work of a trade; and the other the investigations, designs, combinations, etc., which may be termed strictly professional.

When a man has developed into the strictly professional class, he should have moved out of the difficulties under consideration, and, except where there are low ideas of professional conduct among engineers themselves, he has left most of them behind. However, most of the work done by the engineer in ordinary practice is in the lower grade, there being enough of the higher property to place the work in the hands of the trained engineer, but so much of the lower that many untrained men believe they can do the work, and that the public generally believe almost any one can do it who can do the mechanical part of it. This is the field which is now so full of weeds and for the clearing up of which there is so much need of organization. It is difficult to induce the American Society to move in the matter, because so many of its leaders are not personally affected, and possibly for other reasons no more satisfactory. The ordinary local or state association of surveyors or engineers is too likely to lose sight of the higher and more important aims and to reduce its organization to the level of a trades-union. Some society with the proper admixture of material will yet treat the subject in an adequate manner, and give an impetus to the movement that will do much to lift the ordinary practicing engineer out of his present low estate. Two or three of the state associations now have the matter under serious consideration.

Water Meters. Two interesting papers upon the use of water meters were read at the recent meeting of the New England Water-Works Association which present a few points worthy of emphasis. The works at Atlantic City, N. J., had very nearly reached their capacity when the city assumed control of them, and it was determined to try the effect of meters before proceeding with the enlargement. Although many services yet remain unmetered, and the number of services has been increased nearly 20 per cent., the saving in coal has been a gross ton a day, and the pressure has been materially increased in many places. The latter is partly due to new connecting mains which have been laid. The saving in coal, from what it would have been without meters with the increased number of services, pays the interest on the cost of the meters and their maintenance. The principal sources of waste have been found to be hopper closets and unmetered beer-pumps. The meters tend to diminish the receipts, but the reduction in consumption offsets this. The city owns the meters and will extend them to all taps. The rates are 12 cents a 1,000 gallons. The city is following the general tendency at this time and will charge city funds with a sum for public purposes. A definite favorable report upon the use of meters, with figures showing details, such as this, offsets many unfavorable reports based upon false sentimental grounds, such as the one from Savannah, Ga., noted in the last number.

The other paper on the use of meters on a factory fire supply concludes that they are not advisable unless there is no other possible way of detecting waste or stealing, because the loss of pressure amounts to a large proportion of the head, in some four-inch meters being as high as forty pounds, and if the moving parts stick the friction loss is seriously increased. If meters must be used, one of the current type is recommended, as the loss of head is less than in disc and piston meters, and they should be placed on by-passes with gates in the straightway connections which can be opened readily if necessary.

Buffalo Water Rates. Under the present ordinances it is understood that nearly all the revenues of the Water Department are derived from the water consumers. The annual reports of the department do not give all the items of disbursements and presumably do not give a similar amount of receipts from some source or other. This defect in the reports was discussed on page 173 of the March number, 1897. So far as the report for 1895 states, for example, the total receipts for the year were $642,023, of which $29,307 was from the city. There was a deficiency on January 1, 1896, of $250,499, which must be met by drafts on some city fund.

This deficiency was increased about $135,000 during the year 1896. The amount paid by the city is out of all proportion to the amount it should pay, and the entire deficiency should be met from city funds. It is now proposed to amend the city ordinances so that the city will pay about one-third of the expenses of the department. This will certainly be no more than the city's share, and careful computation on lines similar to those frequently discussed in these columns may show that the proportion is too small. One-third of the ostensible receipts for 1895 would amount to $214,000, which, when the deficiency for the year and the city payment are provided for, would leave about $50,000 surplus. This will not give much opportunity for reduction of water rates, but will prevent the increase in rates which is inevitable under the present management. What effect the unreported receipts and disbursements would have on this computation can not be conjectured.

American Society of Municipal Improvements. An attractive programme has been arranged for the meeting of the American Society of Municipal Improvements, which seems to be a judicious mixture of work and recreation. A full day of work is provided for Tuesday, and there is plenty of material on the programme for profitable sessions on the mornings of Wednesday, Thursday and Friday. The Exposition will be visited Wednesday afternoon and evening, and Belle Meade on Thursday afternoon, the usual banquet occurring Thursday evening. The good programme, the special attractions and the low rates to Nashville, should induce a large attendance and a successful meeting.

Berlin Sewage Farm. The system of sewage irrigation in use at Berlin, Germany, has been so great a success that many wonder why it can not be as successful everywhere. The reason is not difficult to find. The soil on the Berlin sewage farm is a light-colored sand of very uniform size, somewhat smaller than the sand in use generally for water filtration. When there has been sufficient growth of vegetation to produce a light covering of loam, the general character of the soil is changed but little. The soil before the sewage irrigation is begun can support but little vegetation, and there was almost nothing on the farm before its use for the present purpose but a sparse growth of pine timber and a little grass. No special preparation of the beds is necessary, therefore, aside from laying the effluent drains, grading the beds slightly to place the flow of sewage over the surface under complete control, throwing up the divisions between beds and preparing the trenches to distribute the sewage to the beds. Nearly all of the structures are of a primitive and temporary nature, but they answer their purpose quite as well as more elaborate structures, are

less expensive in first cost, and probably but little more expensive to maintain. The average cost of preparing the land for use is reported to be about $125 an acre and the cost of the land about $200 an acre, making the total cost about $325 an acre.

Chicago Streets. The mayor of Chicago has returned from a trip to eastern cities, including New York, and has found that it is possible for the largest cities to have well-constructed streets and to have them kept clean. He comes home with the determination to secure proper construction. New York methods of street cleaning are also to be tried. It must be comforting to Chicago citizens to see that their officials are finally discovering facts which have been well known for so long in neighboring cities. It is the first step towards a realization in their own city of the conditions which have existed to a greater or less extent in many neighboring cities. Good work and economical administration can only be secured if the departments of street construction and street cleaning are removed as far as possible from politics. Clean streets were not secured in New York until a non-partisan chief with full power was secured.

The civil service cause in Chicago is being pushed forward under many difficulties and discouragements, on account of the positive antagonism of nearly all of the office-holding class and the indifference or lukewarm support of most of the citizens. As a consequence the enforcement of the law is not complete, and many of the results are unsatisfactory. The failures are, therefore, not to be attributed to the new system, but to the strong efforts to neutralize its effects by partial or wrongly directed enforcement. A permanent good effect upon the character and condition of the streets of the city can only be secured by a complete application of the civil service laws to the departments, and a complete divorcement from politics. Occasionally, a strong political "boss," with the proper turn of mind, has been able to put these departments into excellent condition, but they have fallen back into the old ruts on his removal from control, and the result has been obtained by an excessive expenditure of money. Good work must be paid for, but too high a price can be paid for it. It remains to be seen whether Chicago's mayor will adopt the plan of "Boss" Shepard, for example, with fair chances of failure, or will attempt to place the departments on a permanent non-partisan basis.

Progress on Cincinnati Water-Works. The two members of the last expert commission residing outside of Cincinnati have been retained as consulting engineers on the construction of the new water-works. In conjunc-

tion with the chief engineer of the water-works, G. Bouscaren, they have reported in favor of locating the intake for the new supply near the Kentucky side of the river, the pumping station being located on the Ohio side, opposite. This will require a tunnel eight feet in diameter and about 1,400 feet long, through bed-rock. A group of four 30,000,000-gallon pumping engines is contemplated ultimately.

The proposed emergency intake is not recommended, but a conduit from the clear well east of the Miami river to an emergency pumping station is recommended, this conduit to be of steel, lined with one ring of brick set in Portland cement, giving an inside diameter of 7 feet 2 inches, with a tunnel through rock under the Miami river, 8 feet in diameter. The conduit would be 18,300 feet long and the tunnel 1,300 feet long. As an alternative to this a tunnel direct from the eastern pumping station, lying principally on the Kentucky side of the Ohio river and crossing it twice, is suggested, as it would cost but little more than the other and would be more stable and permanent. Specifications for the large pumping engines have been prepared. They will be discussed hereafter.

Civil Engineers as Pioneers of Civilization.

The practical work of civil engineers in promoting civilization, well recognized by thoughtful people, is emphasized somewhat in Richard Harding Davis' latest story, "Soldiers of Fortune," the leading character of which is a young engineer. The tribute to the achievements of men in this profession, in a bit of dialogue which we quote below, applies particularly to those who build railroads through the wilderness, but equally noble is the work of those engineers who are solving the problems of municipal life by so improving the physical condition of cities that healthfulness and comfort are increased, ease facilitated, refining influences introduced in ways that reach even the great mass of the wretched, thus raising civilization to a higher level in the populous centers:

"There are no men to-day, Miss Langham!" King exclaimed, suddenly turning towards her, to "my mind who lead as picturesque lives as do civil engineers, and there are no men whose work is so little appreciated."

"Really?" said Miss Langham, encouragingly.

"Now, those men I met," continued King, settling himself with his side to the table, "were all young men of thirty or thereabouts, but they were leading the lives of pioneers and martyrs—at least, that's what I'd call it. They were marching through an almost unknown part of Mexico, fighting nature, and carrying civilization with them. They were doing better work than soldiers, because soldiers destroy things, and these chaps were creating and making the way straight. They had no banners either, nor brass bands. They fought mountains and rivers, and they were attacked on every side by fever and the lack of food, and severe exposure. They had to sit down around a camp fire at night and calculate whether they were to tunnel a mountain, or turn the bed of a river or bridge it; and they knew all the time that whatever they decided to do out there in the wilderness meant thousands of dollars to the stockholders somewhere up in God's country, who would some day hold them to account for them. They dragged their chains through miles and miles of jungle, over flat alkali beds and cactus, and they reared bridges across roaring canons. We know nothing about them, and we care less. When their work is done we ride over the road in an obser-

vation car, and look down thousands and thousands of feet into the depths they had bridged, and we never give them a thought. They are the bravest soldiers of the present day, and they are the least recognized. I have forgotten their names and you never heard them. But it seems to me the civil engineer, for all that, is the chief civilizer of our century."

What Constitutes a Paved Street.

The city of Grand Rapids has been discussing the definition of the term pavement, as there is a difference of opinion between the council committee and the property owners upon the matter.

It has been customary in that city to consider a street improved by graveling as not belonging to the class of paved streets. The particular street under discussion has been improved by placing a layer of cobblestones on the foundation and covering them with gravel, thus making a sort of telford pavement, using cobbles and gravel instead of stone blocks and broken stone. The council committee contends that the street is simply a gravel street, while the property owners claim that the cobblestone foundation makes the street a paved street. The point is that if the street is a paved street the street railway company must pay the expense of paving between its rails and tracks and eight inches outside, while if it is a gravel street the property owners must pay the whole cost. The council committee admits that if the cobblestones were on the surface and the gravel were underneath the street would be a paved street.

It is certainly difficult to draw the line in street improvements between pavements and improvements which are not pavements. So far as ordinary conversation and common opinion is concerned, it makes no practical difference, except that the higher the line is drawn the better the class of pavements the city will secure. Thus, in some cities neither cobblestone, macadam, or gravel are considered as pavements, while others draw the line lower down, some including all gravel streets in their list of pavements. This is exemplified in the tables of length of paved streets, given in the last census of statistics of cities and makes it impossible to draw from them fair comparisons of city progress. The cheapest material considered to be "pavement" is usually the most popular, and thus the higher the line is drawn the better the general average of the pavements of the city.

When a legal definition of "pavement" is required, such arbitrary lines can not be drawn readily.

Webster's definition of "pave" is:

to lay or cover with stone, brick or other material, so as to make a firm, level or convenient surface for horses, carriages or persons on foot, to travel on; to floor with brick, stone or other solid material.

The Century dictionary defines a pavement as,

a floor or surface-covering of flags, stones, tiles, or bricks, usually laid in cement, but sometimes merely on a foundation of earth, or, particularly in ancient examples, accurately fitted in masonry without artificial bond; also, such a covering made of concrete and sometimes of wood.

However macadam is defined as an abbreviation for macadamized pavement.

The Standard dictionary gives:

> a hard solid surface-covering for a floor, road, or footway, usually resting immediately on the ground. Pavements are commonly of stone, brick or concrete, but sometimes of wooden blocks. * * * * Some kinds of pavement are named, (1) from their form, use, or material. * * (2) from men who invented or introduce them, or the place where first used as, Belgian, * * Nicolson, * * Telford (large broken stone packed with smaller pieces, covered with a layer of finely broken stone or gravel and rolled hard and smooth).

But macadam is "broken stone for macadamizing, or a pavement or roadway made therefrom."

These definitions are not intended for technical men, but are for general use, and differ just as the general ideas about pavements have been stated to differ.

If we go to technical authorities for our definitions, we find that Rankine does not class macadam and telford roadways with pavements, and calls the stone block layer in a telford pavement the "bottoming" or "foundation," but is careful not to call it a pavement. Mahan makes a careful distinction, stating in one paragraph that,

> the material in ordinary use for road coverings is stone, either in the shape of blocks of a regular form, or, of large, round pebbles, termed a *pavement* or broken into small angular masses; or in the form of gravel.

Pebble pavements, stone tramways, wooden, asphaltic and cubical stone pavements are all described, and the telford pavement is said to have a "paved bottom road-covering." Macadam and gravel roads are evidently excluded from the class of pavements and the telford pavement can be included on account of its paved foundation.

Herschel, in his essay on "The Science of Road Making," describes macadam and telford roads with broken stone or gravel wearing surfaces, and does not call them pavements. He mentions stone, wood and asphalt under the class of pavements.

In Mr. E. P. North's paper on "Construction and Maintenance of Roads,"' a definite distinction is not drawn, but macadam is never called a pavement, while telford is so termed in text and cuts. Both are sharply distinguished from stone, wood and asphalt pavements.

There is not much more concordance of nomenclature here than in the dictionaries. The preponderance of testimony is to the effect that macadam is not technically a pavement, and there is some more usage in favor of calling telford a pavement than excluding it.

CURRENT INFORMATION.

MEETING OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

Arrangements for the fourth annual meeting of the American Society of Municipal Improvements at Nashville, Tenn., October 5th to 8th, are complete, and the preliminary work of the officers and committees has been well done. The headquarters of the society and the meeting place will be Tulane Hotel, one square from the Union depot. The special railroad rates are somewhat indefinite but John L. Kennedy, treasurer of the society and member of the board of public works of Nashville, says that delegates can avail themselves of the special rates for the Tennessee Exposition, which, from most points, is one fare for the

AUG. HERRMANN,
President American Society of Municipal Improvements.

round trip. He says, "It may be possible that at some points these reduced rates may not be fixed, but no doubt they can be arranged by local agents corresponding with Maj. W. L. Danley, ticket agent at Nashville."

The opening session will be held Tuesday morning, October 5th, beginning at 10 o'clock, with an address of welcome by Governor Taylor on behalf of the state, and Hon. A. S. Williams, president of the city council, on behalf of the city, followed with a response by President Herrmann. The official reports will then be submitted.

Tuesday afternoon the Committee on Street Paving, of which A. D. Thompson, of Peoria, Ill., is chairman, will report, and papers will be read as follows: "Grooved vs. Plain Sides for Street Paving Blocks," W. L. Glazier, city engineer, Newport, Ky.; "The Practicability and Advisability for a City Like Minneapolis to Lay and Maintain Its Own Asphalt Pavements," F. W. Cappelen, city engineer, Minneapolis, Minn.; "Results of One Year's Work with a Chemical Laboratory for Testing Asphalts," Nelson P. Lewis, engineer of street construction and maintenance, Brook-

E. B. GUTHRIE,
First Vice-President A. S. M. I.

lyn, N. Y.; "Asphalt Pavements," Andrew Rosewater, Omaha, Neb.; "Paving-Brick Tests," M. L. Holman, water commissioner, St. Louis, Mo.; "Progress in Street Paving," S. J. Hathaway, president city council, Marietta, O.; "A Few Considerations Regarding Modern Wood Pavements," M. A. Downing, chairman department public works, Indianapolis, Ind.; "Rumbling in

D. L. FULTON,
Secretary A. S. M. I.

Brick Pavements," Ernest Adam, engineer street and sewer department, Newark, N. J.; "Asphalt Street Repairs," A. N. Miller, street commissioner, St. Louis, Mo.

At the evening session the Committee on

Electric Street Lighting, John A. Cabot, of Cincinnati, chairman, will report, and Mr. Cabot will read a paper on "An Ideal System of House-top Construction." Afterwards a report will be submitted by the Committee on Taxation and Assessments. R. E. Horner, chairman, Parkersburg, W. Va., who will also read a paper on "Municipal Taxation." The committees on nomination of officers and next place of meeting will be named at this session.

On Wednesday, at the morning session, a report will be submitted by the Committee on Sewerage and Sanitation, George H. Frost, chairman, Plainfield, N. J., together with a paper on "Purification and Disposal of Sewage." E. H. Keating, of Toronto, chairman of the Committee on Water Works and Water Supply, will present a report, and papers will be read on "Locating and Removing Sources of Pollution from a Surface

J. L. KENNEDY,
Treasurer A. S. M. I.

Water Supply," M. R. Sherrerd, engineer water department, Newark, N. J.; "Filtration of Davenport (Iowa) Water Supply," E. W. Boynton, commissioner, Davenport, Ia. The election of officers and the selection of the next place of meeting will occur at this session. At 2:30 o'clock in the afternoon the society will visit the Tennessee Exposition in a body.

The program for Thursday morning embraces a report by the Committee on Disposition of Garbage and Street Cleaning, Dr. J. L. Hess, chairman; the Committeee on City Government and Legislation, Charles Carroll Brown, chairman, and the Committee on Review, Lansing W. Beach, chairman. Papers will be read on "Disposition of Garbage," by Dr. Kempster, of Milwaukee, and on "The Method of Appointment of Boards of Public Works and Engineers and Checks Upon Their Actions," by Charles Carroll Brown, C. E. In the afternoon the society will visit Belle Meade farm, returning to the exposition for an evening concert, and at 9 o'clock a banquet will be given at the Casino on the exposition grounds.

On Friday reports will be presented by the special committees on Abolishing Railroad Crossings in Cities, H. J. Stanley, chairman, and Electrolysis, F. W. Cappelen, chairman, Minneapolis. Papers will be read as follows: "The Latest Method of Electrolysis Prevention," Harold P. Brown, electrical engineer, New York City; "Coating of Cast Iron and Steel Riveted Pipes," George H. Benzenberg, chairman, Milwaukee, Wis.; "Tests of Coatings for Steel Water Pipe," F. W. Cappelen, city engineer, Minneapolis, Minn.; "The Experience of the City of St. Louis, Mo., with Respect to Municipal Street Sprinkling," Robert E. McMath, president board of public improvements, St. Louis, Mo.; "School Inspection as a Means of Preventing Contagious Diseases," Dr. J. M. Withrow, health officer, Cincinnati, O.; "Bicycle Paths," L. W. Rundlett, city engineer, St. Paul, Minn.

The officers of the society are as follows:

President—August Herrmann, Cincinnati, O.

First Vice-President—E. B. Guthrie, Buffalo, N. Y.

Second Vice-President—William R. Kerr, Chicago, Ill.

Third Vice-President—Ernest Adam, Newark, N. J.

Secretary—D. L. Fulton, Allegheny, Pa.

Treasurer—John L. Kennedy, Nashville, Tenn.

Any municipality is eligible to membership or any officer or employe of a city or consulting engineer in charge of municipal work. The fee for a municipality is $5 and for each individual, $3.

CONVENTION OF MAYORS AND COUNCILMEN.

The national convention of mayors and councilmen, called for the purpose of forming an organization to hold annual meetings and discuss municipal questions, is in session at Columbus, O., at the time Municipal Engineering is going to press. Ample arrangements have been made for the meeting by the executive committee, of which Mayor Samuel L. Black of Columbus is chairman, and invitations have been sent to all cities and towns to be represented. One of the most important papers prepared for the meeting is that by Mr. Edmund B. Weston, C. E., on "The Filtration of Water," which is published in full in this number of Municipal Engineering. The program arranged for the meeting is as follows:

Tuesday, Sept. 28—10 o'clock a. m., call to order by Samuel L. Black, mayor of Co-

lumbus and chairman of the general committee; address of welcome by Asa S. Bushnell, governor of Ohio; response by Carter H. Harrison, mayor of Chicago. 2 o'clock p. m., Fire and Police Departments: Papers on the construction, maintenance, protection and inspetcion of electric wires by municipal authorities, and the increase in dangers of fire by imperfect electrical wiring. General discussion by officials of fire and police department work.

Wednesday, Sept. 29—10 o'clock a. m., Municipal Ownership. Leading addresses on the question of municipal ownership of lighting and water plants and street railways. General discussion by officials of the subject of municipal ownership, the granting of franchises to private companies and the possibilities of revenue therefrom. 2 o'clock p. m., Street Lighting: Addresses and papers on the cost of lighting by contract and by municipal plants, the feasibility of municipal ownership and various systems of street illumination. Participation in the discussion by the delegates to the annual convention of the National Street Lighting Association. 8 o'clock p. m.: Address, "Uniformity of State Laws Pertaining to Municipal Government," by J. A. Johnson, mayor of Fargo, N. D.; address, "The Federal Plan of Municipal Government," by Dr. Washington Gladden of Columbus, O.; address, "Municipal Affairs as Administered in Boston," by Josiah Quincy, mayor of Boston; address, "Outdoor Relief by Municipalities," by Hazen S. Pingree, governor of Michigan and former mayor of Detroit.

Thursday, Sept. 30—10 o'clock a. m., Street Cleaning and Garbage Disposal. Leading addresses on various methods and the cost of street cleaning and garbage disposal. General discussion of the topic by all the delegates. Questions and answers. 2 o'clock p. m., Street Paving: Papers on asphalt, brick, granite and all other kinds of paving materials. General discussion of the comparative qualities, practical uses and cost of the various paving materials. Report of committee on formation of association. 8 o'clock p. m., entertainment tendered to the visitors by the citizens of Columbus.

Friday, Oct. 1—10 o'clock a. m., Water Works and Sewerage: Addresses on public water supply, the necessity for the methods of filtration, and the various methods of sewerage disposal. General discussion. 2 o'clock p. m., the election of officers of the association and the preparation of plans for next meeting. 3 o'clock p. m., annual inspection of Columbus fire and police department. Street parade by both.

In connection with the convention, comptrollers and auditors of cities have been asked by H. L. Rossiter, director of public accounts, and Albert F. Crosby, deputy city auditor of Cleveland, to meet for the purpose of special organization in the interest of their work.

SEWERAGE PLANS FOR BALTIMORE.

The Baltimore Sewerage Commission, composed of Messrs. Merdes Cohen, F. H. Hambleton and E. L. Bartlett, submitted a report to the mayor and city council on Sept. 20. It reviews general considerations with reference to sewerage, such as population, water supply, climatic conditions, rainfall, storm water drainage, cesspools and the disposal of night soil. It describes methods of sewerage with reference to their availability at Baltimore, the oyster interests in Chesapeake bay and the possibility of injury to them by sewage emptied into the bay are discussed.

The commission, in its recommendations, states that in Baltimore it deems it of paramount importance that storm water and domestic sewage should be collected and disposed of separately; that subsoil drainage should also, as far as possible, be separated and disposed of with the storm water; that the storm water should pass by way of the existing storm water drains and natural water courses to the river and harbor as now. From these and their future extensions should be excluded, as soon as the development of the system now recommended makes this possible, all domestic sewage and foul matter except street washings.

It is recommended that the domestic sewage should be collected by a system of high level and low level intercepting sewers, disposed of by a continuous discharge into Chesapeake bay at a point some two and a half miles about due east of the rear range light of the Craighill channel. The high level intercepting sewer, serving about three-fourth of the forecast population of the city, will reach this point by gravity. The low level intercepting sewer will collect at a point on the left or east bank of Jones Falls opposite Water street all the drainage from the outlying low grounds of Fells Point, Oldtown, Locust Point, Ferry Point and such portions of the more central portion of the city as lie below the level of the gravity flow, and from a single pumping station there located will lift and force the low level sewage, about one-fourth of the whole, into the gravity sewer at a point near the intersection of Broadway and

Lombard street, whence all will flow together by gravity to the outfall in the bay.

There are three possible methods of disposal.

1. By dilution into the waters of the bay.

2. By chemical precipitation of the solids and disposal of the effluent into the river or bay.

3. By filtration upon lands in Anne Arundel county.

The second is eliminated as offering no advantages when either the first or third can be made to serve efficiently the desired end, unless, indeed, as a temporary expedient in connection with the ultimate adoption of the third.

The third method is recommended by the consulting engineers, Messrs. Gray and Herring.

It returns to the earth the organic matter originally derived from it, and leaves the watery portion of the sewage remaining after irrigation of the soil and crops to pass off in a state bordering closely to purity.

The complete system recommended by the commission, with disposal by dilution in the water of Chesapeake bay, may be obtained by the expenditure of a sum, which, it is estimated will reach $6,166,000 by the time the outfall works are finished and the reticulation system of laterals extended sufficiently to serve 330,000 persons. This will be increased from year to year as the laterals of the reticulation system are extended and more of the population brought into connection with it, until, when the whole city area is connected with the system in about the year 1925, the estimated cost will reach $10,495,167. This is respectively $1,706,040 and $6,981,636 less than the estimated cost at similar stages of progress of the filtration method of disposal. "Whilst this economy of first cost," the report says, "is found in the disposal of the sewage into the Chesapeake, the saving of annual expense for interest, sinking fund and maintenance is no less marked in favor of such disposal. From the time the works are completed until the debt incurred for construction is paid off, the Chesapeake disposal will cost per annum but about one-third of the annual cost of the filtration method, and when the debt is paid the annual cost of the Chesapeake disposal becomes less than one-third of the other.

The construction of the outfall works will require from three to five years' time, and the average yearly expenditure will be $1,233,000. The total annual expense of operation at first installation will be $247,288. This can be raised by a sewer tax on property connected with the sewers, amounting to an average of $4.20 annually per house.

MAJORITY PETITIONS FOR PUBLIC IMPROVEMENTS IN ILLINOIS.

Many cities in Illinois were greatly concerned lest the law which went into effect July 1 requiring petitions to be signed by the owners of a majority of the frontage before city councils in cities of less than 25,000 inhabintants could pass ordinances for public improvements, would prevent any such improvements for a long time, thinking it would be impossible to get a majority to unite on any form of improvement. Anticipating such obstacles, many city councils passed ordinances right and left in the last days of June preparing for improvements for many years to come. It seems that all this fear was unfounded, as in the last few days petitions have been signed by a majority of owners on streets a half-mile long in both Bloomington and Freeport, asking for asphalt pavement. These were both on streets where ordinances had been passed in June for brick. It seems, therefore, both that majority petitions are not only possibilities but easily procured.

A NEW CITY CHARTER FOR BALTIMORE

An ordinance to create a commission of five persons who shall consider, devise, frame and submit to the legislature a new city charter for Baltimore, Md., was offered at a meeting held by both branches of the city council Sept. 20. The commission shall serve without pay and shall devise a charter for the city which shall contain provision for the proper division and organization of the different departments of the municipal government, the election and appointment of all municipal officers and employes, the collection and appropriation of all revenue raised within the corporate limits and the application thereof to the uses of the corporation, the creation and limitation of municipal debt.

POWERS OF CHICAGO'S COMMISSIONER OF PUBLIC WORKS.

By an act creating the local improvement board, the commissioner of public works of Chicago, Ill., has been made a greater man in the authority which he may exercise than the mayor. The new powers given the commissioner of public works are as follows:

Is president of the local improvement board.

Passes upon proposed public improvements before the same can be acted upon by the council or approved by the mayor.

May certify to the estimated cost of an improvement as being the probable cost of the same.

Must make affidavit as to the ownership

of all property affected by an improvement.

All contracts for the making of any public improvement must be approved by him.

All bids for contracts must come to him.

He shall examine all work being done for or under the direction of the board and all material used, and where it is deficient in character or quality has power to reject the same.

Commissioner L. E. McCann believes that the new law will work well, but in order to avoid a vast amount of special assessments will ask Corporation Counsel Thornton to pass upon the legality of the act. He is also of the opinion that the man who takes the office will have to be one who can devote all of his time to the local improvement board and leave the routine work of the commissioner's office entirely to subordinates.

SALARY OF A WATER WORKS EMPLOYE.

In the test case of Frank B. Egan for a mandamus to compel the Detroit Water Board to continue paying his salary of $1,500 per annum, beginning April 1, 1897, notwithstanding the fact that he was discharged as assistant superintendent of extensions last July, Judge Hosmer decided in favor of the water board Aug. 31. The court held that nothing had been produced to show that Egan was employed for more than a year, or that his employment had actually been affirmed by the board, without which ratification no legal contract could have been made. Mr. Egan has declared his intention of appealing the case to the supreme court.

AMERICAN BRIDGE BUILDERS IN JAPAN.

American engineering skill, labor and material will be employed in the construction of eight railroad bridges that are to be built on the line of the Nippon railway in Japan. The bridges, which are described as of peculiar style and appearance, owing to the engineering difficulties that had to be surmounted and the advantages that were desired in the structures, are of the cantilever style and six of them will be built without the aid of false work. Owing to the fact that the waters of the mountain streams rise sometimes ten feet an hour during the heavy rains, and that a rise of thirty feet has to be provided for, the bridges will be of that hight. The plans were made by J. A. L. Waddell of Kansas City, Mo., who secured the commission through his classmate, J. Y. Mori, vice-president of the Nippon Valley road. Mr. Waddell will not go to Japan at first, but will send trusted engineers and workmen, and will go later to inspect the structures.

CALIFORNIA GOOD ROADS LEAGUE.

The State Good Roads League was organized Sept. 4 at San Francisco, Cal., for the promotion of good roads throughout the state and securing the necessary legislation therefor. Temporary officers were appointed who will work for the organization of county leagues and attend to other business for the league until the first regular election, which takes place in November. The temporary officers are: President, Seth Mann, Alameda; vice-president, T. J. Field, Monterey; secretary, J. L. Maude, Riverside; treasurer, E. M. Welsh, San Francisco; directors, C. Sharp, A. B. Nye, E. B. Jerome, Alameda; J. H. Watkins, Los Angeles; J. A. Woodson, Sacramento; J. A. Filcher, Placer; W. H. Mills, C. A. Adams, F. I. Vassault, S. F. Orris and S. Henderson, San Joaquin; A. P. Stanton and J. A. Linscott, Santa Cruz; E. S. Gray and A. B. Lemmon, Sonoma.

WHEN CHICAGO WATER WILL BE PURE.

Prof. T. C. Chamberlain, professor of geology, University of Chicago, estimates that 2,000 years hence Chicago water will be pure. His claims are based upon the determinations of Prof. G. K. Gilbert of the United States geological survey regarding the water level in different parts of the great lake system, holding that the land is rising to the northeast or settling to the southwest, and that the rise of the lake level at Chicago is about one inch in ten years; that the change of level is such that along a line 100 miles in length at right angles to the axis of tilting it would amount to five inches per century; that in 500 years the lake would (without artificial interference) overflow through its old channel west of the city at high stages of the lake; that at ordinary stages it would overflow in a thousand years; that in 2,000 years it would draw away half of the outflow of the lakes, the other half still following its present course; that in 3,000 years the entire outflow of the upper lakes would be westward through the Chicago outlet. The result of this great overflow westward will give a degree of purity to the water supply which could not be attained with the moderate discharge which the canal system seeks; with a vast outlet the central body of the lake will be moving slowly toward the outlet and will press contamination from the land beckward and cause even such contamination as might occur along the shore at more distant points to closely hug the shore.

NEW YORK CITY'S DISTRIBUTION OF WATER.

After the annexation of the territory to be included in Greater New York, which takes place January 1, 1898, the total daily water supply in the three cities of New York, Brooklyn and Long Island City and in the Queens county towns, will be 325,000,000 gallons, which will place New York City at the head of all cities in respect to the volume of water distributed, while the water shed to be drawn on by New York and Brooklyn is practically unlimited. The city of London, according to recent reports, though in advance of New York in population, will be behind it in the supply of pure and wholesome water, as its present distributing system is 187,580,233 gallons, or a daily average of about thirty-three gallons per capita in a population of 5,675,270. The present average daily consumption in New York City is 225,000,000 gallons, four times greater per inhabitant, than London's. Paris has a population of 2,500,000 and the daily average water supply is 1,000,000 gallons.

FINANCIAL AFFAIRS OF A WATER COMPANY.

A decision was handed down, Sept. 8, by Judge Dykman at White Plains, N. Y., in the case of John R. Drake against the New York and Suburban Water Co., of Mt. Vernon, and others, in which he appoints John M. Digney, of White Plains, receiver, and orders him to sell the property, pay first, second and third mortgages, amounting to $205,000 and pay John R. Drake ten-one-hundred-and-forty-fifths of the balance after expenses are deducted. The balance is to be held until the rights of the owners of the remaining 135 shares are determined.

ELECTROLYSIS IN CHICAGO.

In a report to Commissioner McGann of Chicago, City Electrician Ellicott declares that electrolysis threatens all the city's water pipes, and that within a few years new water mains will have to be laid in all the streets occupied by trolley lines, which would involve an expense of hundreds of thousands of dollars. Investigations made recently on several south side streets revealed the fact that nearly all the water mains had been honeycombed by the electric current escaping from the rails of the trolley lines. In all ordinances passed by the city council for trolley franchises there is a provision requiring the construction of a metallic return circuit, by which it is expected the pipes will be relieved from this current. Commissioner McGann is convinced, however, that the street railway companies have been disregarding this feature of their ordinances.

TO PIPE WATER FROM ADIRONDACK LAKES.

A settlement has been effected in the suit of the New York and Westchester Water company aginst the Hotchkiss and Joseph Richardson estates, in which the entire water works properties are practically turned over to the widows and heirs of the estates. Moses R. Crow, one of the plaintiffs, says that the settlement has been made in pursuance of an arrangement between him and the late Joseph Richardson. The persons now in possession contemplate making extensive improvements, including a scheme to pipe water from the Adirondack lakes.

AN ILLINOIS WATER-WAY CONVENTION.

The Illinois River Valley Association will hold a waterway convention Oct. 31, at Beardstown, Ill. The executive committee is as follows: Chairman, E. M. Husted, Roodhouse; first vice president, Sylvester Allen, Bluffs; second vice president, J. M. Darnell, Rushville; secretary, F. J. Traut, Beardstown; treasurer, R. H. Garn, Beardstown; L. D. Hirscheimer, Pittsfield; W. H. Fulkerson, Jerseyville; C. E. Snively, Canton; J. M. Niehaus, Peoria; J. A. Mattheissen, LaSalle; L. S. Baldwin, Roodhouse.

REPORT ON ROAD MATERIALS AND CONSTRUCTION.

A report on different plans for improving city streets will be presented to the Denver, Col., Chamber of Commerce by Chairman Robertson, of the Chamber of Commerce committee on boulevards, streets and parks. The reports will go into the merits of all materials used, the cost and the method of roadmaking, not only in cities of the United States, but in the larger cities of other countries.

IGNORING PENNSYLVANIA SEWER LAWS.

The decision rendered by Judge White, April 5, 1897, in which he declared the sewer act of 1861 unconstitutional, is ignored by the city of Allegheny, Pa., which continues to file liens against property holders under the old act and its supplements. In his decision Judge White stated that the act of May 16, 1891, relating to street improvements, supersedes all local laws relating to such improvements, except as far as may be necessary to complete improvements that are under way, or to collect assessments made in pursuance of local laws for improvements before the passage of the general law.

NEED OF REPAVING IN CHICAGO.

L. E. McGann, commissioner of public works, Chicago, says the streets of that city are a disgrace to so large a community, and that the heart of the city must be repaved, but before beginning the work the street car companies should vacate all the streets down town which they do not actually need and concentrate their lines on a loop. He says:

"It is possible, too, that with the freeing of the streets from the tracks a plan may be devised by which the heavy traffic teams can be confined mainly on two streets east and west and two streets north and south, thus opening up the better part of the city's heart to the trading public. I have no desire to make the down-town district a pleasure resort. I agree with the business man that it is no place for the bicyclist riding for fun nor for the sight-seer who wishes to enjoy a new buggy or drive a fast horse. These two classes of people have no business down town, but they must be given safe avenues by which they may pass through the business district to any side of the city."

The Times-Herald of Chicago has prepared figures, taken from estimates of the city engineer and the calculations of contractors, on the proposed repaving of the entire business portion of the city, which are as follows: Estimated cost of paving the down-town district with asphalt, $1,354,750; vitrified brick, $1,159,175; granite, $1,357,425; cedar blocks, $871,225; number of miles of street to be paved in heart of city between the Chicago river, north and west, the lake east and Taylor street south, 25.

A SLAG PAVING EXPERIMENT IN CHICAGO.

An experiment with slag paving in lieu of macadam is being made on Pine street, from Michigan to Illinois, in Chicago, under the personal supervision of Commissioner McGann. There is some iron in the slag. It is porous and rolls easily, and traffc upon it does not create a dust. The mass solidifies and in time takes on some of the qualities of steel; it is smooth, easily repaired and pleasant to the eye, and the cost of laying is practically the same as macadamizing. Commissioner McGann hopes to derive some valuable information from the experiment. Dillon & Conlan have the contract.

TO PREVENT CRACKING OF ASPHALT PAVEMENTS.

An experiment is being made by the city authorities in the construction of the asphalt pavement on Ravine avenue, in Peoria, Ill., to prevent its cracking. Cracks an inch wide and extending from curb to curb are left in the concrete base every 300 feet. Cracks are also left in the asphalt, although not apparent to the naked eye, owing to the interstices being filled wtih other material. The idea is that the cracks that occur in asphalt paving are greatly due, first, to the hardness of the mixture when laid, and then to the action of the material when contracting and expanding, as subjected to the alternating influences of heat or cold. The department of public works contends that were spaces left which would allow for the contraction of the concrete there would be no brickling or doubling up of the material as it expands during the heated season.

NEW PUBLICATIONS.

"Experiments on the Carrying Capacity of Large Riveted, Metal Conduits, up to Six Feet Per Second of Velocity of Flow," by Clemens Herschel, 11 pp., $2. New York. John Wiley & Sons, 1897.

Of the 115 experiments here recorded 45 are on a 48-inch conduit with cyclinder joints, and velocities of flow varying from 2.04 feet a second to 6.06 feet a second; 8 are on a 36-inch conduit with cylinder joints and velocities of flow varying from 0.56 to 5.70 feet a second; 24 are on 42-inch conduits with taper joints and velocities of flow varying from 0.96 to 4.99 feet a second; 7 are on a 48-inch conduit with taper joints and velocities of flow varying from 0.89 to 2.04 feet a second; these 84 experiments being made by Mr. Herschel on the conduits of the Jersey City Water Company in 1892, 1893, 1894 and 1896. Six of the experiments are taken from Hamilton Smith's "Hydraulics," being on conduits with taper joints at North Bloomfield, Cal., in 1876, varying in diameter from 0.91 to 1.23 feet and with velocities varying from 4.38 to 6.84 feet per second; the results of other experiments by Mr. Smith in 1873 to 1879 are mentioned, but are not included in the table. One of the experiments is on a 16-inch conduit at Astoria City with cyclinder joints and a velocity of 4.58 feet a second in 1895. Nine of the experiments are on a 108-inch conduit with cyclinder joints and velocities of 0.5 to 4.5 feet a second made by Mr. Herschel in 1887. Five of the experiments are by Darcy in 1850 on pipe with screw joints with diameter of 0.935 feet and velocities varying from 1.30 to 6.67 feet. Ten of the experiments are on the conduits of the Rochester water works, 2, 3 and 3.17 feet in diameter with velocities of 1.47 to 3.91 feet a second, three being made by George W. Rafter in 1890, and seven by E. Kuichling in 1891 and 1895. Ninety-five of the experiments have been made since June, 1890, and twenty were made before 1888. Of these twenty, nine were on a pipe 9 feet in diameter and eleven were on pipes from 11 to 15 inches in

diameter. No attempt is made to produce formula which will represent all the experiments, but coefficients for the discharge formula are derived for each size of pipe for the velocities observed and these coefficients are tabulated. It is considered that more data must be obtained before a reliable formula can be developed. The author's recommendation that all engineers should procure such data at every possible opportunity and publish them should be followed by every engineer who has the advancement of his profession at heart.

There is one adverse criticism of the book. Omitting the paragraph of acknowledgments, six lines of the preface state that portion of the purpose of the book which is indicated above, and fifteen lines are used in stating the second purpose of the book, namely, "to record a remarkable and instructive incident in the development of knowledge concerning the carrying capacity of large riveted conduits"—the "Rochester crime against hydraulic engineering," as it is termed in the heading of the second chapter. The "crime" consisted of the statement in the city report in 1879 that while hydraulic formulae would indicate that the Rochester conduit would discharge but 7,000,000 gallons, one very accurate observation showed that it did discharge at the rate of 9,292,800 gallons a day, accompanied by the statement that "it is to be regretted that from want of time a series of reliable and long continued observations in regard to the actual discharge of our conduit has not yet been made." It seems to be true that but one of the several observations was thus recorded, but as the engineer who made the experiments is dead, and his notes are not in shape for inspection, the statement that but "one very accurate observation" was made can scercely be successfully disputed. Such an indefinite statement, since it is not indorsed by the details of the measurements, scarcely rises to the "dignity" of a crime, though the author gives us the impression that he was misled by these statements, notwithstanding differences in conditions, size of pipe and theoretical considerations whch would point to a different result in the case of the conduit of the East Jersey Water Company. Its share of the space in the book is disproportionately large and by so much detracts from the strength of the book and its merit as a very valuable contribution to the discussion of a most interesting and important engineering problem. The author coud well afford to let time set the whole matter right, after a full statement of the exact facts in the case, and will find that the portion of the book thus criticised will delay the full recognition of his actual position as one of the foremost hydraulic engineers of the age.

Twenty-first Annual Report of the Executive Board of the City of Rochester, N. Y., for the Year Ending December 31, 1896.

In this report Mr. Emil Kuichling, chief engineer of the water works of Rochester, reviews in an interesting and able manner some of the important question which have been under discussion at Rochester and to which reference has been made in this magazine from time to time. He tells first of the apprehensions of contamination of the water supply of Rochester, obtained from Hemlock lake, on account of the increasing utilization of the shores for summer cottages and hotels. The lake is located in a mountainous district twenty-nine miles south of Rochester, at a level 386 feet above the city. To enable the city to properly protect this water legislation was procured providing for the purchase, under condemnation proceedings, of the lake bed and 200 feet of the surrounding shore line. This was accomplished through a commission at a total cost of about $180,000. A general sanitary supervision is maintained over the entire water shed.

Mr. Kuichling's report also reviews chemical and biological examinations of the water, the construction and repair of conduits, evaporation experiments, electrolysis, the use of water meters and investigation of the financial management of the water works, etc.

City Engineer McClintock gives the average prices of paving in Rochester in 1896 as follows: Asphalt, $2.52; asphalt blocks, $2.40; Medina stone block, $2.85; Medina stone on stand, $1.58; brick, $1.85; trap rock macadam, $1.09. He makes various recommendations, including one for an increase of the appropriation of his office expenses to $25,000 per year.

Mayor's Annual Message and Twenty-first Annual Report of the Department of Public Works of Chicago for the fiscal year ending Dec. 31, 1896:

In a city like Chicago, where the events of yesterday are tomorrow ancient history, a report of last year's public work is considered more with reference to accuracy and thoroughness as a record than otherwise, and this is the evident purpose of the rather elaborate volume comprising the official reviews for 1896. There are over 400 pages of it, with many illustrations and maps, and it is altogether probably the most complete that has been issued by the city of Chicago.

That Commissioner of Public Works Downey, now retired by the mutabilities of politics, had a broad comprehension of the difficulties and vast needs of his city is shown by his statement that "Chicago, in comparison with the large cities of the East, is yet a young and unfinished metropolis, still laboring under the disadvantages of a defective city charter and unwise state laws, which are depriving the city of the ability to provide an adequate revenue and are perpetuating an irrational, cumbersome and expensive city, county and town government, complicating and retarding public business at the expense of the tax-payers and to the inconvenience of all citizens." However, without care as to proceeding in the right way, the city is rushing ahead with much needed work and is expending approximately $9,000,000 annually. Of this amount the expenditures in 1896 for new water tunnels, water pipe extension and pumpage were $3,342,490; for sewerage extension and maintenance, $338,973; for street and alley paving and sidewalk construction, $3,357,759; for street and alley cleaning, for salaries, $2,250,458.

In urging the importance of good streets Mr. Downey quite truly says: "The prominence secured and other benefits coming to the city with well paved and well kept streets can never be overestimated. Such a condition increases values and gives comfort and convenience to citizens; it is an evidence of public spirit and stimulates a commendable pride and ambition to improve and beautify homes. Visiting strangers pass judgment upon the character and refinement of citizens by the condition of their streets, and the standard of official enterprise and efficiency is measured by the high or low grade of a city's improved thoroughfares."

The details of the engineering work are set forth in separate reports by the city engineer and the heads of the various departments.

PERSONAL.

G. I. Herrick has been appointed city engineer at Wheaton, Ill.

F. Walker Towns has been elected chief engineer of the water department to succeed Wm. Mories at Camden, N. J.

Henry T. Bingham has resigned his position as water commissioner at Manchester, Mass.

L. E. Chapin has been re-elected city civil engineer for two years at Canton, O.

Nesbit Wingfield has been appointed consulting engineer to the water works commission at Augusta, Ga.

Bert Noble has been appointed assistant in the city engineer's department, Columbus, O., to succeed John H. McCormick, resigned.

Chas. Latham, Milwaukee, Wis., has been appointed city engineer at Wauwautosa, Wis.

Paul C. Nugent has been appointed instructor in civil engineering in the College of Liberal Arts, Syracuse University, Syracuse, N. Y.

John T. Barnett, chief engineeer of the city water works, Decatur, Ill., tendered his resignation to the council, to take effect Sept. 1, 1897.

William H. Waring, street commissioner, at Saratoga, N. Y., died Sept. 5 of blood poisoning caused by the amputation of his foot.

T. T. Flagler, M. Am. Soc. C. E., president of the Holy Manufacturing Co., Lockport, N. Y., died Sept. 5, aged eighty-six years.

John W. S. Reigle, Findlay, O., has resigned his position as city civil engineer. He will be succeeded by Elmer C. Bolton. Edwin Phifer has been appointed county engineer.

William H. Rogers, Middletown, N. Y., has resigned as water commissioner.

Chas. Roth has been appointed secretary of the water works commission to succeed Geo. W. Edwards, resigned, at Cincinnati, O.

Nicholas Simon, chief engineer of the water works, Moscow, Russia, is visiting in this country for the purpose of studying American water works, and more particularly water purification.

Jacob Seabold, deputy commissioner of street improvements, New York City, died Sept. 12, aged fifty-five.

L. A. Dillon, Hamilton, O., has been elected county engineer of Butler county.

F. W. Blackford, Butte, Mont., has resigned his position as city engineer.

G. G. Stryker has been re-elected superintendent of the People's Water Co. at Phillipsburg, N. J.

Frank Steiner, a member of the board of water works trustees, Piqua, O., committed suicide by hanging Sept. 8.

John Suders, a sewer contractor of South Bend, Ind., was killed Sept. 8 at Mishawaka, Ind., by being caught by a caving bank.

Joseph Burr Atkinson, a paving and sewer contractor, died Sept. 5 at Manayunk, Pa.

Thomas F. Kennedy, engaged for many years as a paving contractor at Fredericksburg, Va., died in New Orleans, La., Sept. 9.

MACHINERY AND TRADE.

HENRY R. WORTHINGTON'S LATEST CATALOGUE.

Henry R. Worthington has issued General Catalogue No. 28, describing Worthington pumping engines, steam pumps and hydraulic machinery. It contains many illustrations and the text gives all desired information as to the advantages and uses of the various kinds of machinery, together with tables showing sizes of all parts and a telegraphic code for ordering anything required for quick repairs. The catalogue is a valuable one to have on file wherever machinery in this line is or may be used. It will be sent to any address on application to the Henry R. Worthington Works, Brooklyn, N. Y.

A NEW KIND OF JOINT FOR WOOD BLOCK PAVEMENTS.

Mr. Thomas K. Muir, of Portland, Ore., has patented a new kind of joint for wood block pavement which is highly recommended. It is composed of a stout canvas, or other suitable material, four inches in width, saturated and heavily coated with asphaltum and granulated cork. It is manufactured in convenient lengths and of a uniform thickness of ¼ of an inch, and run off in rolls like canvas, or other leather belting, thus rendering it easy to handle. It is claimed for it that it is absolutely non-absorbent, that it is elastic, will not rot, will permit expansion and contraction of blocks at all seasons, and will maintain an impervious surface. A contract for 15,000 square yards of wood-block paving laid with this joint is now being completed by Thos. K. Muir & Co. in Portland Ore. The joint is very highly commended by City Surveyor Gilham and Street Superintendent Chase, of Portland, and a recent issue of the Idaho Daily Statesman, of Boise, Idaho, says: "Contractor Muir yesterday tore up a section of the paving at the corner of Eighth and Main for the purpose of showing the character of the work. The blocks were pried up with a crow-bar, a difficult proceeding, which resulted in the bending of the crow-bar. The blocks were found to be thickly coated with the asphaltum composition, it being demonstrated that the interstices had been well filled, making the joints impervious."

CUMMER PORTABLE ASPHALT PAVING PLANT.

We are advised by F. D. Cummer & Son Co., of Cleveland, that one of their portable asphalt paving plants can now be seen in daily operation in Detroit in the yard of the Alcatraz Construction Co. "The plant," says Mr. W. M. Cummer, "runs like a top and has an easy capacity for laying 3,000 yards of binder per day and exceeding 2,000 yards of 2-inch topping. The plant is a success in every particular."

RECENT INVENTIONS.

[Reported specially for Municipal Engineering by Alexander & Davis, Washington, D. C.]

588,006. Excavating and Conveying Machine. Joseph L. Potter, Indianapolis, Ind. Filed Nov. 14, 1896. Serial No. 612,104. (No model.) In combination a movable trestle, the movable carriage mounted thereon, the shafts journaled on said carriage, the main and supplemental drums carried by said shafts, the cables or ropes connected to said said supplemental drums, the scoop connected by said ropes to said supplemental drums, the ropes or cables leading from the engine drums and passing over pulleys carried by said carriage and connected to the main drum, the winding of said rope on said engine drums being adapted to either raise or lower said scoop, or advance said carriage, the cable attached to one of said engine drums to advance or pull said scoop on the surface of the trench, the hand rope operating said drum and the rope or cable to pull the carriage toward the engine.

588,437. Street Sprinkler Machine. Albert Johnson, South Bend, Ind. Filed Jan. 11, 1897. Serial No. 618,762. (No model.) In a sprinkler, the combination with the cylinder of a sprinkler head, having a spray opening therein, of a bearing bracket secured thereto, a covering sleeve fitted upon the said cylinder, a guide rod secured to the sleeve fitted upon the said cylinder, a guide rod secured to the sleeve supported upon said bracket and adapted to hold said cylinder thereon.

588,363. Combined Snow Plow, Shovel and Sweeper. Jesse A. Stauffer, McKeesport, Pa. Filed Jan. 21, 1897. Serial No. 620,130. (No model.)

588,753. Road-Scraper. Thomas R. McKnight, Aurora, Ill., assignor to the Western Wheeled Scraper Company, same place. Filed Jan. 10, 1895. Serial No. 534,488. (No model.)

588,882. Dumping Wagon. William Rodenhausen, Philadelphia, Pa. Filed Dec. 11, 1896. Serial No. 615,326. (No model.) A dumping wagon having the sills on its running gear provided with ears, the shafts mounted in said ears having pinions thereon, a wagon body having rack bars and the bars pivoted thereto, the cross-bar connected to the lower ends of said bars and the rack-bar pivotally connected to said bar and engaging said pinions, said rack-bars being

engaged by said pinions and means for rotating said shaft.

588,998. Garbage Incinerating Apparatus. Jeremiah J. Kennedy, Philadelphia, Pa. Filed Nov. 15, 1895. Serial No. 569,091. (No model.) In a garbage incinerator the combination of an air-heating chamber having an air inlet and air outlet; a garbage chamber having an air inlet, outlets for air and vapors from the charge of garbage, inlet and outlet ports in opposite walls, means for maintaining draft channels connecting said inlet and outlet ports through the charge of garbage, flues connecting the inlet ports with the air inlet, flues connecting the outlet ports with the outlet for air and vapors and a flue connecting the air inlet of the garbage chamber with the air outlet of the air heating chamber.

577,806. Purifying Water. H. B. Furness, Cincinnati, O.—The method of forming a filter-bed in a filter, which consists in impregnating a granular bed with a flocculent, flexible and adhesive precipitate formed by the reaction of an alkoline phosphate upon a soluble salt, the base of which forms said precipitate.

577,970. Street Cleaner. J. B. Tilton, Fresno, Cal.—A wheeled street-cleaner comprising a pivotally-suported receptacle provided with a means for vertical adjustment and a scrapper attached to the receptacle by a hinged connection and being provided with a tongue or handle rigidly connected therewith.

578,505. Apparatus for Watter-Supply Systems. W. E. Worthen, New York, and O. Darling, Babylon, N. Y.—In a water-supply system, a storage tank communicating with the delivery-main, and a pump for supplying the tank with water, a compressed-air tank and means for supplying it with air under high pressure and a communication between the air-tank and the water-tank provided with a reducing-valve.

EXPERIMENTS WITH ELECTRICITY AND CONCRETE.

Some experiments in determining the electrical conductivity of cement and concrete of various kinds were described recently in a paper by Dr. Lindeck, who finds that the resistance per cubic foot of pure cement blocks, when dry, is about 144 ohms, and that this falls as low as 43 ohms after immersion for about twenty-four hours in water, while it rises to 820 ohms after being exposed to a heat of 212 degrees Fah. The admixture of sand or gravel with the cement increases its electrical resistance. In cases where blocks were made with one part of the cement to seven parts of gravel their resistance when dry amounted to about 18,000 ohms, when wet 72 ohms, and after exposure at 212 degrees Fah. the resistance rose to about 2,000,000 ohms. If the highest results obtained for airtight concrete be taken at about 1,670 ohms per cubic foot an insulation resistance of about ½ ohm per mile is obtained. These considerations become important when adopting the German practice of laying the rails of electrical railways in concrete. From experiments made with what is called asphalt concrete it appears that the current range is very trifling, and if ordinary cement is used it is only necessary to lay a thin layer of the asphalt concrete over it. The cost is then not excessive. Asphalt concrete consists of 50 per cent. of broken stone, 20 per cent. of coarse gravel, free from loam and sand, 12 per cent. of asphalt, 8 per cent. of coal tar pitch, and 10 per cent. of coal tar.

TRADE NOTES.

Otis & Gorsline, sewer pipe manufacturers at Rochester, N. Y., have dissolved.

The works of the Youngstown Bridge Co., Youngstown, O., were destroyed by fire Sept. 22.

A fine bed of sandstone, suitable for paving purposes, has been discovered near Oakland, Ill.

The Hamburg Vitrified Brick Co., Hamburg, Pa., will manufacture paving brick only hereafter.

The organization of a large company, for the manufacture of vitrified brick, is proposed at Tampa, Fla.

The purchase of a new rock crusher and engine is contemplated at Yorkville, S. C., according to press reports.

The clay of Attica, N. Y., has been tested and found suitable for the manufacture of paving and building brick.

The Illinois Clay Workers' Association will hold the next annual convention in Decatur, Ill., Jan. 5 and 6, 1898.

The purchase of asphalt testing tools has been suggested as a good investment for the board of public works at Saginaw, Mich.

The business men of Mannington, W. Va., are looking into the clay industry with a view of establishing a paving brick plant.

The A. O. Jones Sewer Pipe and Paving Brick Works, Zanesville, O., were completely destroyed by fire, Sept. 13, entailing a loss of $50,000.

D. W. Lynch and James Halpin have been placed in charge of the soliciting department of the Gilson Asphaltum Co. at Kansas City, Mo.

Schillinger Bros. of Toledo, Chicago, Detroit and Cleveland are erecting a large man-

ufacturing plant at Ardmore, Indian Territory, to treat the native asphalt rock.

J. B. Twiford, Angus T. Wright and William Glassman contemplate the establishment of a clay working plant, near Ogden, Utah, to manufacture stoneware, sewer pipe, drain tile and paving brick.

The United States Fire Clay Co., Lisbon, O., will, according to press reports, resume operations in every department. The plant, which is in the hands of a receiver, has been idle for over two years.

The Housatonic River Trap Rock Co., Shelton, Conn., has been incorporated to furnish trap rock for road improvements, by A. S. Onderdonk of Rochester, N. Y., as president; Frank W. Gilbert, New York City, treasurer.

The Warren-Scharf Asphalt Paving Co. complied with the law regarding corporations doing business in Illinois, and on Sept. 11, named John S. Stevens as its representative, and Peoria as headquarters, certifying to $15,000 worth of property in the state.

The Buffalo Brick association was organized Aug. 10 at Buffalo, N. Y., with W. H. Brush as president; Charles Berrick, vice-president; O. J. Swegles, secretary; O. W. Weyer, attorney and manager. The organization has decided to abolish the long credit system followed by many contractors.

The Dagus Clay Manufacturing Co., Daguscahonda, Pa., has been incorporated to manufacture and sell brick, tile, sewer pipe and other clay products by J. J. Hoblitzell, Myersburg; W. S. Ravenscroft, S. A. Rote, M. S. Kline and John J. Whitmore of Ridgway.

We are advised by Mr. Theo. F. Miller, secretary and treasurer of Henry R. Worthington, that branch offices for the Henry R. Worthington business have been opened at Nos. 713-717 Perdido street, New Orleans and in the Century building, No. 317 North Ninth street, St. Louis.

The Dunn Manufacturing Co., Pittsburg, Pa., recently shipped to Murphy Bros., Washington, D. C., 24 dozen of a heavy pattern of their patent combined iron and timber braces for use on a $300,000 sewer contract at that place. They also report an exceptionally heavy demand for their patent trench braces.

The Potomac Cement Co., Keedyville, Md., has been incorporated and will construct and operate a plant at Antietam, Md. The incorporators are Henry A. Jones, Washington, D. C.; Joseph A. Blundon, Riverdale, Md.; Charles Earl, Riverdale, Md.; H. H. Warner, Kensington, Md.; Samuel H. Campbell, Washington, D. C.

The Miller-Knoblock Co., South Bend, Ind., manufacturers of street sprinkling wagons, etc., is adding an electrical department, with the intention of manufacturing and carrying in stock Morrell's improved essembled motor commutators for street railway motors, and armature coils for all the standard motors. This department will be under the management of A. W. Morrell.

The Ohio Stone Paving Co., 374 E. Federal street, Youngstown, O., has about completed the abutments for the sixteen hundred feet of bridge, at Knoxville, Tenn., and has the floors and walks to build yet. The company is also laying a concrete floor upon a new bridge in Youngstown, and has about seven thousand yards of fire proofing in cement to be completed this fall. The company works in cement entirely.

From Canadian Architect and Builder: "The rate at which brick for pavements is growing in favor in Toronto can be gauged by the fact that the local paving brick factory is unable to keep up with the demand. In consequence, the construction of brick pavements is at present at a standstill. It is understood that the manufacturers are taking steps to greatly increase the capacity of their works. If other cities and towns, following the example of Toronto, should adopt brick as a paving material, as doubtless they will, there will be room in Canada for several paving brick manufactories."

The General American Reduction Co. was incorporated Aug. 18 at Trenton, N. J., to dispose of city garbage, which, it is claimed, will be boiled with steam and sulphuric acid added to accomplish deodorization; the greases are then separated and the remainder passed into a dryer where the liquids are evaporated; the residuum is a black powder which makes an excellent basis for fertilizers; the gases evolved in the process are utilized as feed for the reduction of still more garbage. The garbage emerges from the dryer as a fertilizer. The company expects to compete for the garbage contract in New York City. Samuel M. Roosevelt, 1052 Fifth avenue, New York City, is president and Daniel R. Case, Bristol, L. I., vice-president.

SELECTIONS FROM THE PRESS.

HOW TO MAKE A PROSPEROUS CITY.

If the pople of St. Joseph intend to receive their portion of the general prosperity that is now sweeping over the country, they must begin to do something that will draw it hither. A city progresses and becomes prosperous by reason of the progressiveness of its people Municipal pride tends to build up a place faster than any other means. If we desire foreign industries to locate in the city, we must show them that we believe in its future, its progress, its facilities, its convenience and resources by developing its municipal equipments. If property owners expect real estate to be valuable, they must interest themselves in securing thoroughfares that are satisfactory. Well paved, well kept streets promote a city's interests and add materially to the value of property. Tenants do not desire houses on dusty streets that suffer from lack of repairs, when they can secure houses on streets which are in much better shape.

The subject is an all-important one and should not be neglected. Where the difficulty lies is in securing material that will be lasting. Most of the streets of the city have been macadamized. These have been repaired until there is no foundation left for repairs. They must be entirely rebuilt. When this is done—and it must be done, if not right away, very soon—the city engineer and members of the council should administer the funds for this purpose in a way that will prove of lasting benefit. Saving on street paving is sometimes false economy. It is better to expend a great amount of first cost and save on repairs, than it is to save on first cost and exhaust the street department fund by constant and costly repairs. This is amatter that ought not to suffer delay. The sooner the city administration will take it in hand the better it will be for the city's future. Paving the streets will put money into the pockets of the men who need it, and who are looking for work. It will help the laborer, help the business man and raise the value of property. It will add to the beauty of the city and create a new era of municipal prosperity.—St. Joseph (Mo.) Herald.

GOOD ROADS PAY IN FRANCE.

Why does the nimble-witted Frenchman spend $18,000,000 per year to maintain good roads? His quick answer is, "It pays." He knows that a horse can take to market twice as much on a macadam road as on a dry dirt road, and four times as much on the average dirt road in average condition and eight to ten times as much as when the dirt road is turned to mud by the fall and spring rains. He also realizes fully its effect in shortening the distance to market; its effect on land values; its saving to wagons, horses, etc.; he knows that it quickens social communications and adds wealth to the individual and the state. The American farmer will doubt this, but the Frenchman knows this, for he has tried both ways.

This country stands today in greater need of road missionaries than road engineers. We need both, but we want one hundred missionaries to one engineer. At present, the ratio is about reversed. When a majority of the land owners know that good roads pay, we shall have good roads, and that soon, too. How this educational work can best be carried on is a question upon which some differ. Massachusetts, Vermont, New York, New Jersey, California and other states (at least ten years in advance of Minnesota in this matter) are believed to have found a solution. They have, uniformly, created a state commission, first to take the whole matter under advisement and, after two years' work and study of the question in all its legal, economic, engineering and local bearings, have reported back to the legislature with recommendations for suitable legislation.—Prof. W. R. Hoag in Minneapolis Times.

IGNORANT OPPOSITION TO PUBLIC IMPROVEMENTS.

"There is no darkness but ignorance." In nothing is the truth of these words realized more forcibly than in overcoming the difficulties in the way of bringing about the intelligent improvement of towns. An enlightened understanding of the need and benefits of it must be supported with clear judgment, unfailing tact and immovable fixedness of purpose on the part of those who take the lead in public spirited work of this kind. A recent instance of what must be overcome, how to do it and the general satisfaction afterward is found in the beginning of an era of improvement in the town of Bluffton, Ind. The story is told by the Bluffton Banner as follows:

"The settlement of our street improvement question has been a great triumph of good judgment and settled purpose on the part of the mayor and council. A few months ago when the question of street paving began to be seriously talked of there was a great variety of opinion, and opposition in various forms was strong and uncompromising. There were all kinds of pretexts brought up against street improvement in general and asphalting in particular. Many who stood

in the way of any kind of improvement cloaked their opposition under the guise of objections to immediate work and particularly to asphalt at any time. Many well meaning citizens made themselves very busy in the part they took in the matter. They would stand on the street corners and endeavor to pump great quantities of wisdom into the mayor and members of the council who would become patient victims of the process. They discoursed upon the folly of attempting to do anything with the streets for two or three years yet, until the sewer trenches are thoroughly settled. If street improvement must be made they pointed out how much better brick was than anything else; how suicidal to the interests of the city would be the result if the evident purpose to put down asphalt was adhered to. Our citizens are well acquainted with the multitude of excuses and arguments that were brought to bear upon the mayor and council to swerve them from plans and purposes which they had arrived at after months of careful and painstaking study and investigation. The city authorities pursued their own wise councils and never swerved an inch from what they had determined to do in the matter. In the meantime the leaven was working; there was a campaign of education going on which brought the most natural results. The mayor and council knowing well what would be the outcome of the discussion that was going on thought that they could well afford to be patient and forbearing with those who opposed their plans through ignorance of the nature of modern street building, and so it has gone on until now when our asphalt streets are under contract and must be begun within a few days. The remaining opposition, if any, has melted away, and the city authorities that have worked under circumstances which at times were most trying have the satisfaction of knowing that their plans are very generally approved, and that when the streets are completed as they will be in a few months, everybody will be enthusiastic over them."

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Orange, N. J.—The South Orange Township Committee decided, Sept. 2, to repair all roads hereafter with broken stone and stone dust instead of loam.

Des Moines, Ia.—The city council has decided to direct the contractor to proceed with the paving of Sixth avenue, between Center and Chestnut streets, and that the grade of the hill be left as it is.

Camden, N. J.—Under a law passed by the last legislature the officials of the Camden and Marion turnpike are trying to sell the turnpike, which is ten miles long, to the counties of Camden and Burlington, at $6,000.

Camden, N. J.—A tour is being made through the various cities for the purpose of inspecting asphalt pavements, by Charles Sayres, president of the council; Councilmen Edwin Mills, F. W. George, Albert Feigner, Daniel Lamb, L. Mohrman and William L. Gibson; L. E. Farnham, city engineer; John Blowe, superintendent of streets; Aaaron Ward, Fletcher Blakeley and Dr. H. H. Davis.

Des Moines, Ia.—In an opinion relative to this city's right to construct a boulevard along the edge of the river, City Solicitor Macomber agrees with the contention of the park commissioners, viz., that the city is not clothed with any legal authority to locate and construct the boulevard as contemplated by the contract between the city and Contractor Killmar.

Des Moines, Ia.—A decree dissolving the permanent injunction granted some time ago in the case of James H. Windsor vs. the City of Des Moines, the Des Moines Brick Manufacturing Co., et al., places the Des Moines Brick Co. in position to proceed with the work of more than a mile of paving on Grand avenue, although it is stated that as soon as it undertakes the work another effort will be made to prevent progress by the filing of a case in the federal court or by appeal of the present case to the supreme court of the United States.

CONTRACTS TO BE LET.

Elwood, Ind.—Bids will be received until Oct. 4, for grading S. A street. Will Hupp, cy. clk.

Marietta, O.—Bids are asked until Oct. 9 for improving Front street. Carl Becker, cy. clk.

Vermillion, S. D.—Bids will be received until Oct. 4 for grading a road. Fred Heglin, co. audt.

South Bend, Ind.—Bids will be received until Oct. 11 for constructing cement sidewalks. L. A. Hull, cy. clk.

Kansas City, Mo.—Bids are asked until Oct. 2 for asphalt and brick paving. Henry A. Wise, cy. engr.

Darby, Pa.—Bids are asked until Oct. 4 for paving Pine street with macadam. C. E. Drewes, chrm. highway comrs.

Paterson, N. J.—Bids are asked until Oct. 4 for macadamizing E. Thirty-eighth street. Edward N. Kevitt, chrmn. bd. chosen freeholders.

Newington, Conn.—Bids are asked until Oct. 4, for constructing a section of Telford and macadam road. H. M. Robbins, selectman.

Warren, O.—Bids are asked until Oct. 7 for constructing about 2,857 square yards of

brick paving in S. Park avenue. Albert E. Andrews, cy. clk.

New Brunswick, N. J.—Sealed bids will be received until Oct. 6 for macadamizing 5,627 feet of a road. Robt. J. Dougherty, co. engr.

Louisville, Ky.—Bids are asked until Oct. 6 for paving several streets with brick, block, asphalt, macadam. Aaron H. Kohn, chrm. B. P. W.

Canton, O.—(Special.)—Bids will be received until Oct. 4, for paving W. Lake street with vitrified paving blocks. L. E. Chapin, cy. engr.

Wabash, Ind.—(Special.)—Sealed proposals will be received until Oct. 11 for about 2,000 square yards of lake asphalt paving. Robt. P. Woods, cy. engr.

Newton, Ia.—Bids will be received until Oct. 16 for about 7,900 square yards of brick paving and 4,350 lineal feet of Portland cement curbing. A. C. Gates, cy clk.

Findlay, O.—Sealed proposals will be received until Oct. 4 for grading, curbing and paving First street, with vitrified block or brick. A. W. Ray, clk bd. of imp.

Crown Point, Ind.—Sealed bids will be received until Oct. 6, for the construction of a free gravel road in Calumet twp. Jas. M. Bradford, chrmn. bd. co. comrs.

Paoli, Ind.—Sealed proposals will be received until Oct. 14 for constructing 155,189 ft. of gravel and macadamized roads. Geo. W. Tegarden, co. audt.

Toledo, O.—Sealed proposals will be received until Oct. 11, for repaving Seventeenth street, from Adams to Washington, with Trinidad Pitch lake or Bermudez asphalt, or vitrified or granite blocks. Lem. P. Harris, cy. clk.

Brooklyn, N. Y.—Bids will be received until Oct. 4, for repaving with asphalt portions of Cedar and Cooper streets, and for repairing with granite Park avenue, from Hudson avenue to Broadway. Theo. B. Willis, comr. city works.

Rock Island, Ill.—Sealed proposals will be received until Oct. 4 for paving First avenue, from Sixteenth to Twentieth streets with brick. Contractors are required to furnish samples of brick. A. D. Huesing, cy. clk.

St. Louis, Mo.—Sealed proposals will be received until Oct. 8, for grading, curbing, guttering and paving with asphalt, brick, telford, granitoid, macadam and granite blocks, a number of streets, avenues and alleys. Robt. E. McMath, prest. B. P. I.

Bellaire, O.—Bids will be received until Oct. 8 for breaking, hauling and spreading limestone on pikes as follows: Pike No. 1—300 cu. yds.; Pike No. 2—200 cu. yds.; Pike No. 4—100 cu. yds.; Pike No. 5—150 cu. yds. Geo. Kern, prest. Pultney twp. trustees.

Terre Haute, Ind.—Sealed proposals will be received until Oct. 5, for paving the sidewalks of Fourteenth street, from Locust street to Third avenue, with cement, and curbing with Mansfield sandstone or Oolitic limestone; also, for paving the roadway with screened gravel. Chas. H. Goodwin, cy clk.

Washington, D. C.—United States Minister Buchanan, Minister to Buenos Ayres, reports to the Department of State that bids are to be asked for in the United States, England and France, for paving 150 blocks in the city of Buenos Ayres with asphalt. The specifications and forms of proposal will be forwarded to the Argentine Legation in this city.

St. Louis, Mo.—Sealed proposals will be received until Oct. 8, for grading, paving, etc., at H. S. Pumping Station, Nov. 3, at Baden, the approximate quantities of which are as follows: Earth excavation, 1,400 cu. yds.; borrowed earth, 900 cu. yds.; concrete, 7,900 cu. ft.; brick paving, 15,700 sq. ft.; 8,600-ft. 6-in. granitoid, 7,300 sq. ft.; 4-in. granitoid; 595 lin. ft., 15-10-8-6-in. pipe sewer; 7 small catch basins with iron covers; 3 large catch basins with iron covers. Robt. E. McMath, Prest. B. P. I.

CONTRACTS AWARDED.

Lacrosse, Wis.—The contract for macadamizing Clinton street has been awarded to Miller & Williams.

Oshkosh, Wis.—The lowest bid for macamizing Wisconsin avenue was presented by Oliver Pretty.

Moline, Ill.—A contract has been awarded to Tim Kennedy for constructing sidewalks for $2,871.61.

Oswego, N. Y.—The Warren-Scharf Asphalt Paving company secured the contract for paving W. Mohawk street with asphalt.

Pendleton, Ind.—The contract for paving State street with brick was awarded to C. H. Daniels of Anderson, Ind.

Independence, Mo.—The contract for grading and macadamizing Swope boulevard has been awarded to Colyer Bros. for $5,000.

Bennett, Pa.—John Butterfield of this town has been awarded the contract for paving Butler street with brick for $3,972.25.

Urbana, Ill.—John W. Stipes secured the contract Sept. 10 for paving Romine street and University avenue with brick at $1.10 a square yard.

Evansville, Ind.—Bedford, Weikel & Nugent have been awarded contracts for paving three alleys with brick at $1.36, $1.37 and $1.38 each.

Jackson, Mich.—The contract for paving W. Main street with brick has been awarded to T. C. Brooks.

Saginaw, Mich.—The Alcatraz Asphalt Paving company has been awarded the contract for paving Weadock avenue and Harrison street at $1.29 a sq. yd.

Litchfield, Conn.—The contract for building a roadway has been awarded to John S. Lane & Son of Meriden at $1.97½ a lineal foot.

St. Joseph, Mo.—The Barber Asphalt Co. secured the contract for paving the street east of the City Hall, from Felix to Edmond.

Sudbury, Mass.—The contract for constructing about 2,200 feet of state highway was awarded, Sept. 9, to A. J. Wellington of Boston for $3,042.

Meadville, Pa.—The contract for paving Chestnut street with brick has been awarded to Ross & Robinson of this city at $1.26 a square yard, or $13,800.

Syracuse, N. Y.—The Asphaltina Construction Company secured the contract, Sept. 14, for paving S. Salina street, from Newell to Brighton.

Syracuse, N. Y.—The Columbia Construction Co. presented the lowest bid for paving W. Willow street, from N. Clinton to W. Genesee street, which aggregated $4,154.

Independence, Mo.—The Missouri Construction Co. has been awarded the contract for laying a second sidewalk on Maple avenue at $1.08 a lineal foot.

Kansas City, Mo.—Contracts for brick paving in two streets have been awarded as

follows: Fred Feigel, 439 square yards, $1.52½; M. Mense, 3,138 square yards, $1.48.

Cincinnati, O.—The contract for paving Corry street with brick was awarded, Sept. 16, to J. M. Quill for $3,202.50; Highland avenue, P. Gleason & Co., $3,568.75.

Old Saybrook, Conn.—The contract for macadamizing a section of Main street was awarded, Sept. 16, to A. Brazos & Sons, of Middletown, at 84¾ cents a lineal foot.

Joliet, Ill.—The contract for paving Jefferson street with asphalt was awarded, Aug. 30, to the Bermudez Asphalt Paving Co. at $2.61 a square yard, with seven-year guarantee.

Baltimore, Md.—The contract for paving Twenty-third and One-Half street, between Guilford avenue and Barclay street, with cobble-stones, has been awarded to Patrick Reddington.

Boston, Mass.—The contract for building a road in the Stony Brook Reservation was awarded, Sept. 13, to Owen Cunningham & Son of Somerville, Mass., for $10,160.

Irvington, Ind.—The contract for laying a cement walk on Grand avenue, from Irvington to Beechwood avenue, has been awarded to G. T. Roberts of Attica, Ind., at 63 cents a lineal foot.

Mason City, Ia.—The contract for brick paving was awarded to Frank McCann of Fort Dodge, Ia., at $1.58 a square yard for paving and 47 cents a lineal foot for Portland cement curb.

Irvington, Ind.—The contract for paving Washington street with brick has been awarded to the Capitol Paving & Construction Co. of Indianapolis at $3.53 a front foot each side.

Saginaw, Mich.—Bids were received Aug. 28 for the third time for paving S. Jefferson avenue, and the contract was awarded to the Barber Asphalt Paving Co. at $1.19 a square yard.

Newark N. J.—The Essex County Park Commissioners awarded contracts, Sept. 7, for the granite steps and rubble masonry at Branch Brook Park to F. C. O'Reilly of Orange for $2,600.

Westport, Kas.—The contract for paving McGee street, from Thirty-first to Thirty-third street, with Trinidad lake asphalt, has been awarded to the Barber Asphalt Paving Co. at $2 a square yard.

Norristown, Pa.—The McAvoy Vitrified Brick Co., near Phoenixville, secured the contract Sept. 7 for furnishing between 5,000,000 and 6,000,000 bricks for street paving at 66 cts. a square yard.

Alton, Ill.—The contract for 27,000 square yards of brick paving in this city has been awarded, according to press reports, to Nelch, Patterson & Striffler of Springfield, Ill., at 88 cents a square yard.

Stamford, Ct.—Street paving contracts have been awarded as follows: L. Blondel & Co. of this city, Catskill repressed brick, $2.07 a square yard; C. W. Blakeslee & Son of New Haven, dimension granite, $3 a square yard.

Philadelphia, Pa.—The contract for the construction of the new bulkhead and the widening and paving of Delaware avenue, from Vine to South streets, was awarded, Aug. 31, to D. J. McNichol for $475,000.

Boston, Mass.—The Barber Asphalt Paving Co. has been awarded the contracts for paving Cabot street, between Vernon street and London Park, 14,000 square yards, and Lincoln Place, between Worcester and W. Springfield, 312 square yards.

Baltimore, Md.—The contract for furnishing vitrified paving brick for repaving Park avenue, between Reservoir street and Newington avenue, has been awarded to D. P. Guie of Williamsport, Pa., at $17.50 a thousand.

Cleveland, O.—Contracts have been awarded as follows: Brecksville road to John L. Farley, $14,900; paving Lorain road with brick, Sept. 8, Degnon-McLean Construction Co., $52,317; improving public square, Sept. 9, C. F. Spahlinger, $55,000.

New York, N. Y.—The Barber Asphalt Paving Co. has secured contracts for 31,109 square yards of asphalt paving, at prices ranging from $2.79 to $2.96 a square yard for five years and from $4 to $4.50 a square yard for fifteen years, including curbing.

Cincinnati, O.—The contract for paving with granite Eden avenue, from Stetson to Arizona street, was awarded to M. Byrne for $10,300. Herman Suer was awarded the contract Sept. 4 for constructing the new Indian Hill road, for $30,631.

Paterson, N. J.—Contracts for grading, curbing and guttering have been awarded as follows: Sixteenth and Lowe streets, John Agnew; Butler and Plum streets and Fourteenth avenue, A. H. Smith; Hine street, C. R. Forbes; Fourteenth and Getty avenues, C. Kelly.

Hamden, Conn.—State road contracts have been awarded as follows: Macadamizing road in Hamden, C. W. Blakeslee & Sons, New Haven, 95 cents a lineal feet; road in North Branford, Ford & Gates, No. Branford, $1.23; road in Northfield, Conn., Samuel D. Maltby, Northford, $1.38.

Tuscumbia, Ala.—Contracts for building pike roads in Colbert county have been awarded as follows: George L. Young, Birmingham, and Tracy Abernothy, Tuscumbia, $16,000; A. D. Thompson, Sheffield, $20,000; L. A. Rorex, Cherokee, Ala., $6,000.

Newark, N. J.—Paving contracts were awarded Sept. 23 as follows: John F. Shanley, Wallace-place, $10,502; Warren street, $16,772; flagging Elizabeth avenue, Jacob Clark, $1,436.87. A motion to award the contract for paving Camden street with asphalt to John F. Shanley was voted down.

Detroit, Mich.—The contract for paving two alleys with asphalt was awarded, Sept. 6, to the Western Bermudez Asphalt Co. at $1.25 a square yard. Liphardt & Winterhalter secured three contracts and John Hanley one contract for paving an alley with cobblestone at 40 cents a square yard.

Des Moines, Ia.—The board of public works awarded contracts, Sept. 13, as follows: Curbing Enos street, from Tenth to Eleventh, Tim O'Brien, 31½ cents; paving Twelfth street, from High street to Woodland avenue, with brick, J. W. Campbell, $1.21 a square yard; paving alley in block 2 with brick, C. E. Kooker, $1.41.

Oakland, Cal.—The contract for constructing sidewalks, driveways, curbing and culverts around the high school building was awarded Sept. 16 to Hillhouse & Reardon at the following prices: Sidewalk, 11½ cents a square foot; curbing, 14½ cents and 5 cents a lineal foot; culverts, 65 cents a lineal foot.

Jersey City, N. J.—Bids were received Sept. 13 for 1,970 square yards of asphalt paving on Church street and 3,100 square yards on Fairview avenue, as follows: Barber Asphalt Paving Co., Church street, $1.65; Fairview avenue, $1.63; New Jersey Mexican Asphalt Co., $1.95 a square yard each; California Asphalt Co., $1.98 a square yard each.

Brooklyn, N. Y.—The contract for paving eight streets with asphalt has been awarded to Cranford & Co. for $188,977. The bid submitted by the Eastern Bermudez Co. was lower than that of Cranford & Co., but the company required 55 days in which to do the work against 50 days by the former company.

Scranton, Pa.—Bids were received Sept. 16 for paving with brick on 6 inches of concrete as follows: Keystone Paving Co.—Paving, $1.77 a square yard; curbing, 6x12 inches, 58 cents a lineal foot; circular curb, $1 a lineal foot and 15 cents for curb reset. M. J. Ruddy—Paving, $1.75; curbing, 6x12 inches, 49 cents; circular curb, 85 cents.

Milwaukee, Wis.—Contracts for asphalt paving were awarded Sept. 14 as follows: Warren-Scharf Asphalt Paving Co.—E. Water street, 2,780 square yards, $2.31; Third street, 7,705 square yards, $2.30; Wells street, 4,215 square yards, $2.29; Sixth street, 4,433 square yards, $2.30. Western Paving & Supply Co.—Broadway, 5,655 square yards, $2.28; Prospect avenue, 5,827 square yards, $2.12.

North Adams, Mass.—The contract for 1,600 square yards of brick paving on Main street was awarded Sept. 2 to the New York Brick & Paving Co., of Olean, N. Y., at $2.24 a square yard. The contract for paving Marshall street with granite blocks was awarded Sept. 14 to W. H. Lally & Co., city, at $1.09 a square yard and 10 cents per lineal foot for setting curbstone.

Hartford, Conn.—The contract for paving Church street with Trinidad Pitch Lake Asphalt was awarded Sept. 8 at $2.59 a square yard to the Southern New England Paving Co. Cadwell & Co., New Britain, secured the contract for a new macadam road on Silver street at $1.04½ a lineal foot and for repairs to the south end of Main street at $1.89 a ton for stone used.

Macon, Ga.—The contract for paving Fourth street with granite cubes was awarded to the Georgia Quincy Granite Co., of this city, at $2.58 a sq. yd. The other bids presented were as follows: John Bradley, Atlanta, $2.68; M. T. Lewman, Atlanta and Louisville, $2.92; Macon Paving Co., Macon, $2.77; Birch & Caldwell, Macon, $2.82; Venable Bros., Atlanta, $2.70; Cooks & Laurie, Montgomery, Ala., $2.60; Will R. Maher & Co., Atlanta, $2.64¾.

Indianapolis, Ind.—Contracts for street improvements were awarded, Sept. 20, as follows: Rogers & Dunlap—Cement walks, Alabama street, from Sixteenth to first alley south of Nineteenth, 66 cents.; Beecher street, from East to Shelby, 46 cents; north side St. Clair street, from Park ave. to Massachusetts, 58 cents, for five-foot and 35 cents for three-foot walks. D. Foley—Brick, first alley east of Central, from Fifteen to Sixteenth, $1.39; Osage, from Washington to Market, $1.25.

Spokane, Wash.—Bids wer received, Sept. 16, for paving Howard street with vitrified brick on 6-in. concrete, as follows: A. E. Barrett—Foundation, $1.20 a sq. yd.; paving, Little Falls, brick, $1.75. J. D. Farrell & F. McClellan—Foundation, $1,220.56; paving, Denny brick, $1.70; Little Falls brick, $1.50; Robert Russell offered to do the work this fall at $1.16 2-3 for foundation and $1.60 for brick, or next spring at $1.23 for brick. The bids have been taken under consideration.

Jamaica (L. I.), N. Y.—The Warren-Scharf Asphalt Paving Co. presented the lowest bids Sept. 9 for improving the Brooklyn and Jamaica road, as follows: Excavation, 43,000 cu. yds., 24 cts.; curb, 43,625 lin. ft., 65 cts.; curb corners, 206 ft., $12.50 each; bridge stone, 10,960 sq. ft., 60 cts.; brick on macadam, 70,000 sq. yds., $1.81; brick on concrete, 50,000 sq. yds., $2.35; asphalt on concrete, 50,000 sq. yds., $2.85; relaying flagging, 55,000 sq. ft., 3 cts.; 10 catch basins, $65 each; iron pipes, culverts, 50,000 lbs., 1½ cts.

Brooklyn, N. Y.—The Eastern Bermudez Asphalt Co. presented the lowest bid Sept. 10, 95 cts. a sq. yd. for paving with asphalt portions of Gerry street, Throop avenue, Floyd street, Lewis avenue, Glenada place, Albany, Grand and Washington avenues. The only other bid received was from Cranford & Co., $1.07 a sq. yd. The lowest bid received for macadamizing Avenue C, from Flatbush to Coney Island avenue, was from Fred Luck, which was $19,908 with Belgium block gutter and blue stone curb, and $20,479.71 with combined concrete gutter and curb.

Chicago, Ill.—Special.—The Barber Asphalt Paving Co. has been awarded the contract for paving Cottage Grove avenue, from Twenty-second to Thirty-third street, with asphalt on 5-inch concrete base, re-inforced with expanded steel, at $2.10 a square yard; including grading and curbing, the bid aggregated $58,871. The other bids recived were as follows: Bermudez Asphalt Co., $2.12 a square yard, or $59,359; Assyrian Asphalt Paving Co., $2.09 a square yard, or $60,061.50; Illinois Paving Co., $2.27 a square yard, or $65,383.50. The total amounts of the bids include grading and curbing.

Omaha, Neb.—Bids were received Sept. 3 for paving Sixteenth street as follows: Hugh Murphy—Asphalt, 17,265 square yards, class C, five-year guarantee, $1.22; class E, five-year, $1.50; brick, 2,401 square yards; class C, five-year guarantee, $1.10; stone, class D, one year guarantee, $1.50; foundation, 4¼ inches broken stone on old concrete base; Grant Paving Co.—Asphalt, class C, five-year, $1.43¾; class E, five-year, $1.48¾; brick, class C, five-year, $1.18; stone, class D, one year, $2. Omaha Brick and Construction Co.—Brick, class C, five-year, $1.09; stone, class D, one year, $1.90; foundation, 1½ inch binder. Iowa Brick Co.—Asphalt, class C, five-year, $1.49; brick, class C, five-year, 90 cents.

CONTEMPLATED WORK.

Paterson, N. J.—About 53,434 square yards of asphalt paving is contemplated.

Tekamah, Neb.—Brick paving is contemplated for the streets of this city.

Los Angeles, Cal.—The council has been petitioned to construct two boulevards.

Stillwater, Minn.—The council has voted to pave Water street, from Chestnut to Nelson.

Green Bay Wis.—The question of paving with brick or macadam is being considered.

Springfield, Ill.—A resolution has been passed to pave Monumental avenue with a double course of brick.

Spokane, Wash.—Plans have been adopted by the council for paving Main street with asphalt.

Kansas City, Mo.—Brooklyn avenue, from Fifteenth to Twenty-fifth street, will be paved with brick.

Mannington, W. Va.—The city council contemplates paving the principal streets with brick.

Bay City, Mich.—The estimated cost of repaving Center avenue with cedar blocks is $12,439.

Raleigh, N. C.—This city has voted to issue $50,000 in bonds for street improvements, chiefly grading and curbing.

Dayton, O.—Grading, graveling and paving has been decided upon by the council for several streets and alleys.

Lincoln, Neb.—Bids will soon be asked for asphalt and brick paving. City Engineer Bonstedt.

Oakland, Cal.—The question of macadamizing Clay street, from Eighth street to San Pablo avenue, is again being agitated.

Portland, Me.—The public works commission voted, Sept. 17, to pave Center street with Belgian blocks.

Winona, Minn.—The city council decided, Sept. 13, to macadamize Gilmore avenue, from Clark's lane to Villa street.

Hartford, Conn.—The board of street commissioners voted, Sept. 8, to pave Asylum street, from Main to Ford, with block asphalt.

Conshohocken, Pa.—An ordinance has been passed appropriating $7,000 for grading and macadamizing several streets.

St. Louis, Mo.—An ordinance has been adopted for paving Olive street, between Grand and Vanderventer avenues, with natural rock asphalt.

Minneapolis, Minn.—City Engineer Cappelen estimates about 203,000 square yards of paving and 43,000 feet of curbing will be laid during 1898.

Seattle, Wash.—Yesler way is to be improved by means of stringers carrying a roadway made of planks on edge called "vertical grain."

St. Joseph, Mo.—The city officials are considering methods of abolishing second-class sidewalks and laying brick walks in their place.

Columbus, Ind.—(Special.)—G. W. Suverkrup, city clerk, says that bids for paving the streets will not be advertised until after the first of the year.

Trenton, N. J.—Specifications are being prepared for the proposed brick paving in Dillon's alley, and for telford paving in Pennington avenue.

Rock Island, Ill.—Press reports state that the city council may reconsider its action in ordering the girder bridge planked with oak and use asphalt instead.

Denver, Col.—The board of public works passed a final resolution, Sept. 18, authorizing the paving of lower Sixteenth street, near Wazee, with stone blocks.

Springfield, Mass.—The board of supervisors has decided upon macadam as the paving material to be used between the car tracks on the State street hill.

Stockton, Cal.—Resolutions of intention have been published ordering the macadamizing of Lindsay, Vine, Stanislaus and Poplar streets. T. B. Littleton, st. supt.

Allegheny, Pa.—The committee on public works has declared forfeited the contracts for improving Voegtly and Ellsworth streets and Irwin avenue and will readvertise the work.

Cleveland, O.—Resolutions have been adopted for paving with brick portions of Randall, John, Taylor, Whitman, Courtland, Muirson, Church and Scott streets. Howard H. Burgess, cy. clk.

Peoria, Ill.—Paving estimates have been presented by the city engineer as follows: Water street, from Chestnut to Main, $13,000; North street, from Main to the north city limits, $25,000.

Denver, Col.—The property-owners on Champa street, between Nineteenth and Downing avenue, have petitioned for asphalt paving. Petitions are also being circulated for paving portions of Curtis, California and Broadway streets and Eighth avenue.

Binghamton, N. Y.—Brick paving is proposed for Front street, between Webster Place and North. City Engineer Monroe is of the opinion that it can be done within the limits of the paving fund.

Washington, D. C.—Notice of intention has been published for the construction of vitrified or asphalt block paving in a number of alleys and cement sidewalks with curbs, etc., in sundry streets.

Bloomington, Ill.—A petition will be presented to the council asking for asphalt paving on McLean street, between Chestnut and Locust. Plans have been made to pave the street with brick, from Chestnut to Clay.

Rockaway Beach, (L. I.), N. Y.—Brick paving has been decided upon by the board of trustees for Sea Side avenue, from the Long Island railroad to the surf, and Hammels avenue, from the Long Island railroad to the boulevard.

Brooklyn, N. Y.—Theodore B. Willis, commissioner of city works, has recommended that Newall street, between Norman and Nassau avenues, be repaved with vitrified brick, in accordance with the request of the property-owners.

Sedalia, Mo.—Resolutions have been passed for paving with American bituminous rock asphalt and curbing Sixth street, from Grand avenue to Quincy avenue, and from Lafayette avenue to Lamine avenue. W. O. B. Dixon, cy. clk.

Saginaw, Mich.—The property-owners on S. Michigan avenue, from Court to Vermont, contemplate petitioning the council for a sewer for the entire length of the street this year, and to repave it with asphalt next year.

Saginaw, Mich.—The matter of paving Hamilton street has been laid over until next year, owing to the council ordering the execution of a contract of brick paving against the wishes of three-fourths of the property-owners, who petitioned for asphalt.

New York, N. Y.—(Special.)—Appropriations for asphalt pavements were made by the board of estimates and apportionment, Sept. 23, as follows: Paving Eighth avenue, from Fifty-ninth to One Hundred and Twenty-fifth street, $317,000; other streets, $307,936; total, $624,936.

Philadelphia, Pa.—In his report to the park commission, Gen. Russell Thayer, superintendent of Fairmount Park, recommends that the drive from Belmont to Chamounix be macadamized, and that bi-

cycle paths of vitrified brick be laid on each side of the driveway.

Toronto, Ont., Can.—Paving is contemplated as follows: Brick on concrete, Bellevue avenue; cedar block, Walmer road and Charles street; gravel, Beasonsfield, Cowan and Peel avenues and Lisgar street. Brick paving has been recommended for the entrance to the College street fire hall, to replace the decayed wooden pavement.

Columbus, O.—Ordinances were passed Sept. 7 for filling the holes in the asphalt pavement in Broad street, from Third to Parsons avenue, with Trinidad asphalt, and for paving Eighth avenue, from Neil avenue to Hunter street, with asphalt, granite or other stone block or vitrified brick or block. John M. Doane, cy. clk.; Mark Elleman, prest. cy. coun.

St. Paul, Minn.—A final order has been passed for paving Central avenue, from St. Peter to Harriet street, with brick, and a preliminary order has been passed for paving Broadway, from Seventh to Grove; Cedar from Second to Como; Rice street, from Tenth to Front; Summit avenue, from Wabasha to Sixth; Tenth street, from St. Peter to Rice.

Milwaukee, Wis.—A special meeting of the council was called for Sept. 20 to pass an ordinance to pave Prospect avenue, from Brady street to Kane Place, with asphalt. By passing the ordinance at that time the council hoped to save nearly a month of time, for the men who were at work between Albion Place and Brady street would be enabled to go on with the paving north of Brady street.

Atlanta, Ga.—E. C. Peters, chairman of the finance committee of the city council, suggests that Whitehall street be improved by widening it five feet on each side and paving one side with Belgian block and the other side with chert, the county commissioners to pay cost of paving one side with chert and the property-owners to be relieved of the expense of improving that side.

Chicago, Ill.—The property-owners on Diversey avenue are anxious for that street to be improved as a boulevard. Henry Winter, George Duncker, Henry Wendel, Alderman William Schlake, J. J. Kane and Dr. Bacon have been appointed a committee to get an opinion from the corporation counsel as to the rightful ownership of the street and to confer with the park commissioners in regard to their position regarding the matter.

Quincy, Ill.—While the mayor and aldermen have not fully decided what paving shall be done next year, it is probable that Spring street, from Front to Fourth, will be paved. Ordinances creating a board of public improvements, in compliance with the law passed by the last legislature, were introduced in the city council Sept. 6 and all preliminary steps are being taken for letting contracts next winter.

Newark, N. J.—Notices of intention were passed Sept. 23 for grading and curbing S. Seventeenth street and Delavan, Lincoln and Third avenues. Notices of intention have also been passed for paving portions of Rowland and Crittenden streets with brick and Lafayette street with oblong granite blocks. The Essex Bicycle club proposes to petition Mayor Seymour and the board of works to construct asphalt strips on Broad street to connect the asphalt of Washington Park with that of N. Broad street; also a wide strip on Belleville avenue, from Harvey street to the Gully road.

SEWERS.

Hartford, Conn.—The state sewerage commission consists of Prof. Edward H. Jenkins, New Haven; John S. Cheney, South Manchester; John N. Woodruff, Sherman; Robert A. Cairns, Waterbury; Fayette L. Wright, Pomfret. The commission is appointed by the governor and is to serve without pay, except for expenses, and shall investigate the subject of sewage disposal of the cities, boroughs and towns of Connecticut and report at the next legislature.

Hamilton, Ont.—The recent examination of various sewage disposal works in different parts of the United States by the city council and city engineer is looked on as a determination on their part to improve on the works recently erected when the contracts are let for the second plant. City Engineer Barrow is satisfied that by combining sand filtration with chemical precipitation he can improve on the system used at the east end disposal works.

San Antonio, Tex.—The plan proposed by Katz, Crandall & Katz, the contractors for repairing the outfall sewer by placing iron bands fifty feet apart, is not favored by the sewer committee, which is of the opinion that they will not adequately remedy the evil, but believes that the most practicable and only serviceable mode of repair would be by means of brick butttresses with a good foundation, at intervals of twenty-five to thirty-five feet.

Savannah, Ga.—The committee of citizens appointed to investigate the condition of the canals, drains, ditches, swamps and watersheds in the suburban districts contiguous to the city, recommends that the whole convict force be concentrated on the canals, ditches and drains immediately around the city and kept at work on them until they are thoroughly cleaned out, repaired and built to completion upon the plans already adopted; that when this is completed each watershed or part of watershed, which has not been thoroughly and systematically drained, be taken up according to its proximity to this city and a thorough system of drainage on scientific and well-digested plans be constructed in it; that a force of twenty-five or thirty trained men be constantly employed in cleaning out, repairing and maintaining in good condition the drains constructed around the city.

CONTRACTS TO BE LET.

Newark, O.—Bids are asked until Oct. 4 for constructing a tile sewer on Central avenue. C. S. Brady, cy clk.

Richmond, Ind.—Bids are asked until Oct. 15 for constructing sewers in two alleys. J. H. Winder, clk. B. P. I.

Chillicothe, O.—Bids are invited until Oct. 4 for constructing sewers; estimated cost, $7,500. H. M. Redd, cy. engr.

Montclair, N. J.—Bids are asked until Oct. 4 for constructing 8-inch pipe sewers in four streets. H. Triffett, town clk.

Norristown, N. J.—Bids are asked until Oct. 18 for constructing sewers in two streets. P. F. Hunter, chrm. sewer com.

Quincy, Mass.—Bids are asked until Oct.

7 for constructing 5,155 feet of brick and 1,050 feet of pipe sewers. H. F. Whitman, chrmn. comrs.

Evansville, Ind.—Bids will be received until Oct. 9 for constructing a main sewer in Grove street. Geo. W. Swearingen, clk. B. P. W.

St. Louis, Mo.—Sealed proposals will be received until Oct. 8 for constructing pipe sewers and catchbasins. Robt. E. McMath, prest. B. P. I.

Michigan City, Ind.—Sealed proposals will be received until Oct. 11 for the construction of a 12-inch sewer on York street. Albert H. Leist, cy. clk.

Elkhart, Ind.—Sealed bids will be received until Oct. 16 for the construction of a sewer in Center street, from Madison to Monroe. Kit McKean, cy. clk.

St. Paul, Minn.—Bids will be received until Oct. 2 for constructing a sewer on Cleveland avenue, from Selby to Dayton avenue. W. F. Erwin, clk. B. P. W.

Brooklyn, N. Y.—Bids are asked until Oct. 5 for constructing a main relief sewer for Bond, Lorraine and Walcott, sts., and for sewers in District 38. T. B. Willis, comr. cy. wks.

Cincinnati, O.—Sealed proposals will be received until Oct. 4 for constructing sewers and drains with appurtenances in Kinsey and Highland aves. and McMillan st. Aug. Herrman, prest. B. of A.

Wahpeton, S. D.—Sealed proposals will be received until Oct. 18 for the construction of a sewer on Pembina st., from Ninth st. to the Red river, a distance of ten blocks. E. A. Aspinwall, cy. audt.

CONTRACTS AWARDED.

Meadville, Pa.—Ross & Robinson bid $14,343 for 500 feet of storm sewer in Market street.

Marshalltown, Ia.—The contract for constructing sewers was awarded to M. V. Kennedy of Des Moines for $1,649.

Oakland, Cal.—Kimbal G. Easton was awarded the contract for constructing a culvert over Sausal creek, for $3,448.

Maquoketa, Ia.—The contract for constructing a sewerage system was awarded, Sept. 17, to Hanlon & Knepper of Sioux City.

St. Louis Mo.—The contract for constructing a sewer in Osage street has been awarded to G. Eyermann, jr., of this city, $8,371.50.

Rochester, N. Y.—H. N. Cowles was awarded the contract, Sept. 3, for the construction of the Hague street sewer, for $4,939.25.

Manitowoc, Wis.—J. H. Green & Son of Appleton have been awarded the contract for 2,265 feet of additional sewers for $1,550.

Lynn, Mass.—The contract for constructing a section of the outfall sewer was awarded to C. C. Blanchard for $26,664.

Oneida, N. Y.—The contract for constructing the lateral sewer lines has been awarded to Geo. S. Miller of Rome for $14,684.12.

Shelbyville, Ind.—Dobbins & Kenning of this city secured the contract for constructing 615 feet of 30-inch sewer at $1.45 a lineal foot.

Cincinnati, O.—The contract for constructing the Bloody Run trunk sewer has been awarded to John McDonnell for $32,437.60.

Ripon, Wis.—The contract for constructing sewage disposal works has been awarded to Harding & Nelson of Racine for $2,398.40.

Allegheny, Pa.—J. M. Ransom has been awarded contracts for sewers as follows: Marshall avenue, $1,264; Page street, $778.40; Eckert street, $3,745.

Pottstown, Pa.—An ordinance has passed second reading granting privilege to the Pennsylvania Sanitation Co. to construct a sewerage system.

Cleburne, Tex.—The contract for constructing 1,200 feet of sewer, three and one-half feet in diameter, has been awarded to Mike Sloan, of Weatherford.

Norwood, O.—The contract for sewerage construction in District No. 2, South Norwood, was awarded Sept. 2 to Jas McClain for $26,101.10.

Marshall, Mo.—The contract for sewer construction has been awarded to Colyer Bros., of Independence, as follows: District sewer, $4,851.45; public sewer, $399.

Newark, N. J.—The Essex County Park Commissioners awarded the contract Sept. 7 for drainage, etc., at the Orange Park to James Seme for $3,838.75.

Philadelphia, Pa.—The contract for constructing the sewers in connection with the new bulkhead on Delaware avenue was awarded to D. J. McNichol for $45,000.

Somerville, N. J.—The contract for constructing about 4 miles of 8 to 20-inch pipe sewers was awarded Sept. 13 to Hardgrove & Gillmore, of this city, for $15,559.70.

Milwaukee, Wis.—G. E. Zimmerman has been awarded sewer contracts as follows: 1,952 feet pipe sewer, 81 cents a lineal foot; 52-foot brick sewer, $3.10 a lineal foot; 1,166-foot pipe sewer, 67 cents a lineal foot.

Erie, Pa.—E. Driscoll secured the contract for a sewer in Twelfth street at the following prices: Nine-inch pipe, 30 cents; 6-inch pipe, 25 cents; manholes, $30 each; catchbasins, $29 each.

Omaha, Neb.—The contract for constructing 386 feet of 8-inch sewer was awarded Sept. 10 to Connelly & Shaw at 34 cents a lineal foot laid in Portland cement and 33 cents laid in American cement.

Altoona, Pa.—(Special).—Harvey Linton, city engineer, says that sewer contracts were awarded Sept. 3 as follows: Isaac Bender, $3,053.11; Charles B. Clark, $1,511.56; Orner & Shellenberger, $879.57.

Rochester, N. Y.—W. H. Jones & Sons secured the contract for building a sewer in Hinsdale street for $3,165.50 and John Mauder the contract for a sewer in Yale street and South avenue for $2,077.60.

Two Harbors, Minn.—The contract for constructing about 400 feet of 18-inch pipe sewers in concrete, 400 feet 12-inch pipe sewers in sand and 1,100 feet of 8-inch sanitary sewers of Duluth for $3,997.

New York, N. Y.—Clapp & Shipman, 45 Broadway, were awarded the contract, Sept. 13, for completing the unfinished alteration and improvement to the sewer in Sixty-fourth street, between Madison and Fifth avenues, for $8,959.

Clearfield, Pa.—Short & Monaghan secured the contract, Sept. 20, for constructing about 1,800 feet of 18-inch pipe sewer in Locust street as follows: Pipe, 24 cents a lineal foot; pipe fittings, Y's and T's, 87 cents; excavating, laying pipe, back filling, etc., 24¾ cents a lineal foot; manholes, 8 feet, $18.90.

Des Moines, Ia.—W. A. Youngerman secured contracts, Sept. 13, for sewer construction as follows: Chestnut street, from Bluff street to Des Moines

river, a 3-foot 2-ring brick sewer, $1,133.45; Franklin avenue, from Bluff street to connect with the Franklin avenue sewer, a 36x44-inch egg-shaped 2-ring brick sewer, $287.70.

Milwaukee, Wis.—The contract for section 5 of the Thirtieth street tunnel was awarded, Sept. 20, to C. J. Crilley at $27.93 a lineal foot, or $41,531.91. The section contains 1,487 feet and will bring the sewer up to the intersection of Thirtieth and Walnut streets. Of this sewer 4,986.5 feet have already been built at a cost of $112,263.13, and the fifth section will increase the number to 6,473.5, and the cost to $153,795.04.

Detroit, Mich.—Langley & Jeynes secured the contract, Sept. 9, for constructing the Sixteenth street sewer at $5,724.50. Bids were received Sept. 6 for constructing six sewers and five of the contracts were awarded to James Grant. The unsuccessful bidders endeavored to influence the board of public works to throw out the bids on the score of irregularity, and failing in this, offered to put up certified checks that if the bids were readvertised lower prices would be obtained. Contractor Grant claims that a sewer ring exists in the city with the object of controlling all the work in this line and fixing a price therefor.

Lawrence, Mass.—The contract for constructing the Shanty Pond sewer 375 feet has been awarded to James Chambers of this city as follows: Tunnel work in rock, $20 per foot; earth excavation in trench, $1.55 per yard; rock excavation in trench, $8 per yard; brick, Am. cement, $13 per yard; brick, Portland cement, $16.50 per yard; concrete, Portland cement, $8 per yard; lumber in place, $40 per M.; under drains, $1 per foot.

CONTEMPLATED WORK.

St. Joseph, Mich.—A sewerage system is contemplated. J. V. Starr, mayor.

Providence, R. I.—Sewers have been petitioned for a number of streets.

Marshall, Mich.—The construction of a sewerage system is contemplated.

Spartanburg, S. C.—This city has voted to issue $50,000 in bonds for a sewerage system.

Palo Alto, Cal.—Plans for a sewerage system are being considered; estimated cost, $60,000.

Anaconda, Mont.—The construction of a sewer is contemplated for District No. 2 at a cost of $2,735.

Tarentum, Pa.—About 3,000 feet of 12 or 15-inch tile sewers are to be laid. F. A. Ready, boro clk.

Ebensburg, Pa.—This town has voted to expend $11,000 for constructing sewers in the west end.

Lead, S. D.—An effort is being made to sell $27,000 in bonds for the construction of a sewerage system.

Pawtucket, R. I.—Resolutions have been passed for the construction of sewers in several streets. Bd. of Ald.

Portland, Me.—A sewerage system will probably be constructed in Fessenden Park, according to press reports.

Lockland, O.—A committee has been appointed to investigate the question of constructing a sewerage system.

Richmond, Va.—An appropriation of $10,000 for sewer construction is proposed. Councilman Rountree interested.

Oxford, O.—Plans for a sanitary sewerage system are being prepared by Gaines & Winterstein of Hamilton.

Mt. Sterling, Ky.—Press reports state that the mayor has been instructed to purchase a car load of sewer pipe.

Wheeling W. Va.—Resolutions have been passed providing for sewerage for parts of the Second and Third wards.

Princeton, Ill.—Surveys and plans preparatory to putting in a sewerage system will be made by Alvord & Shields of Chicago.

Norristown, Pa.—Ordinances have been passed for constructing sewers in two streets. Isaac Taylor, prest. council.

Green Bay, Wis.—Preliminary plans have been completed by the city engineer for the proposed new sewerage system.

Carbondale, Pa.—The council has been petitioned to build sewers in Seventeenth ave. and Spring st. Walter Frick, cy. engr.

Waterbury, Conn.—The borough clerk has been authorized to advertise for bids for laying sewer pipe for storm sewers. N. B. Vertrees.

Los Angeles, Cal.—The construction of sewers in San Fernandino and First sts. and Grand ave. is recommended by Health Officer Powers.

Kewanee, Ill.—A resolution has been passed authorizing the city engineer to prepare estimates of the proposed sewerage system.

Goldsboro, N. C.—The question of issuing $25,000 in bonds for constructing a sewerage system will be voted on. John H. Hill, mayor.

Sandwich, Mich.—A petition has been presented to the town council asking for the construction of a drain from the Huron line to the river.

Vincennes, Ind.—The question of constructing a sewerage system for this city is again revived. Councilman Ebner is interested.

Santa Ana, Cal.—The plans for the sewerage system are generally approved and immediate construction of the system is urged. Bd of Trustees.

Emeryville, Cal.—J. George Smith, town engineer, has been instructed to submit to the board of trustees plans for a sewerage system.

Toronto, Ont.—Engineer Keating and Chairman Saunders are, according to press reports, investigating the subject of sewage purification.

Washington, D. C.—The district commissioners have ordered a number of sewers constructed, chargeable to appropriation for main and pipe sewers.

Pottstown, Pa.—Arrangements are being made, according to press reports, to construct the proposed new sewerage system. R. E. Shaner, cy. engr.

Vailsburg, N. J.—The question of issuing bonds for sewerage and water works construction will be voted on. Fred F. Crane, engr., Orange, N. J.

Omaha, Neb.—The question of issuing $75,000 in bonds for repairing the main sewers of this city will probably be submitted to a vote this fall.

Pasadena, Cal.—The council is considering the feasibility of calling a special election to vote bonds to the amount of about $172,000 for a general sewerage system.

Collinwood, O.—At a recent meeting of the council the sewerage system of this place

was discussed. The citizens are dissastisfied with the present sewer facilities.

Middlebury, Vt.—Plans and specifications for a new sewerage system for that part of the town lying on the west side of the river will be made by A. R. Dow of Burlington.

Mt. Vernon, N. Y.—A resolution was adopted by the common council Sept. 7 to engage competent engineers to examine the sewerage system and report on the best method of sewage disposal.

Statesville, N. C.—This city has voted to issue $16,000 in bonds for sewers and $36,000 for water works and bids for constructing the systems will be received soon after Oct. 15.

Cleveland, O.—Resolutions have been adopted for the construction of main sewers in Bergen, Train and Junction streets, Woodland and Franklin avenues and the boulevard between Desmond and Detroit streets.

Jackson, Miss.—An ordinance was passed Sept. 7 submitting to vote the question of issuing $65,000 in bonds for a sewerage system and $10,000 for street improvements. The time for the election was set for Sept. 28.

Chicago, Ill.—Plans will be submitted for lateral feeders to the drainage channel and the drainage of the Calumet district. The estimated cost for the city work is $1,500,000 and for the Calumet work $5,000,000.

Baltimore, Md.—The construction of a sewerage system with disposal of sewerage by dilution in the waters of Chesapeake bay has been recommended by the sewerage commission; estimated cost, $10,000,000.

Newark, N. J.—Ordinaces were passed Sept. 23 for constructing a brick sewer in Sherman ave., from Earl to Clifton st., with branch pipe sewers in Alpine, Hunter, Stanton, Bigelow and Clifton sts.; also for a sewer in Jacob st., from Springfield ave. to S. Seventh st.

Newark, N. J.—The municipal authorities have decided to secure the services of an expert civil engineer to provide plans for a new sewerage system. The present system was built without foreseeing the present requirements for drainage, and without consideration of providing for the city's growth.

Kansas City, Mo.—In the opinion of City Engineer Wise the first and most important sewer improvements to be made next spring will be the extension of the north end sewers. He recommends the construction of a big main sewer to drain the waters of the O. K. and Turkey creeks, the southwestern part of the city and the west bottoms, to empty into the Missouri river just east of the packing houses. He thinks the central sewer should be as deep as 100 feet and should tap all intercepting sewers. As a temporary relief Dr. Coffin will recommend to the board of public works the use of flush tanks on all the sewers in the city. The estimated cost of the needed improvements is from $300,000 to $400,000.

WATER-WORKS.

Harrisburg, Pa.—The Moressen Water Co. of Westmoreland county was incorporated Sept. 8 by James M. Schoonmaker, James H. Reed, Winfield B. Carson, George B. Motheral and William H. Donner of Pittsburg.

Bismarck, S. D.—In pursuance of an order from the supreme court this city's water works plant, including apparatus, mains, lands and other appurtenances, have been sold to Morison, Waters & White of Baltimore, Md., for $37,000.

Rochester, N. Y.—Justice Werner granted writs of certiorari Sept. 13 in the proceedings for a review of the Rochester city water works property in the towns of Mendon, Brighton, Livonia, Lina and Canadice. The writs are made returnable Oct. 25, when Justice Nash will hold special term.

Chicago, Ill.—The filters which were placed in the public schools fail to work satisfactorily, owing, the agents claim, to insufficient pressure from the city pumps. The filters were placed in the schools by Thomas Cusack and W. A. S. Graham, the contract price being $88,000.

White Plains, N. Y.—John M. Digney of this city has been appointed receiver of the New York Suburban Water Co. and is to take the property, carry on the business until it is sold at public auction for cash, subject to the lien of two mortgages, $200,000 and $5,000 respectively.

Scranton, Pa.—Local capitalists have purchased and consolidated the plants of three water companies in the western part of the state. The directors of the company are: H. M. Brackenridge, Natront; Joseph J Jermyn, Scranton; James J. Lynch, Oliphant; J. D. Stocker, Jermyn; William Walker, Mayfield.

Des Moines, Ia.—An investigation of the quality of the water supply of this city has been made by City Engineer L. Higgins, assisted by Prof. Charles Kinney of Drake university, who finds that the water which is taken from underground galleries along the Raccoon river is of good quality and contains no impurities, except from certain portions of the galleries, which can be shut off without trouble.

Cincinnati, O.—A report has been received by the water works commission from Engineers Bouscaren, Benzenberg and Hermany regarding the selection of locations for the various parts of the new water works, in which they recommend a site for the eastern pumping station adjoining the village of California, where a depth of twenty feet of water at its lowest stage is found near the Kentucky shore, the acquisition of a right-of-way strip, and application to the secretary of war for permission to build an intake pier.

Des Moines, Ia.—City Engineer Higgins and the water committee have submitted their report on the results of their investigation of the establishment of the municipal water plant. They report a satisfactory water supply in the region of Epworth camp and on the east bank of the Des Moines river. The site favored for the pumping station is near the Iowa Brick Co.'s plant. The estimated cost of the new water system is between $600,000 and $800,000.

Newark, N. J.—Reports have been received from Dr. R. N. Connolly, bacteriologist, and Dr. Baldwin, chemist, on this city's water supply which pronounce the water supply now good and contains no disease-breeding germs, but in the watershed there are streams running into the river, reservoirs and intakes containing coli communis bacillus in such quantity as to indicate that they would directly breed the dangerous

germs of typhoid fever, cholera, etc., which flourish under favorable conditions wherever that bacillus is found in large numbers.

Rochester, N. Y.—The suit brought against this city to set aside the proposals made several years ago by Moffett, Hodgkins & Clarke for constructing a part of the new water works system has been decided in favor of the company. The company submitted a bid $63,000 lower than any other competitor and was awarded the contract, after which it claimed that its representative made a mistake in his estimates and wished to withdraw its bid. The court has decided that there is a "clear, explicit and undisputed" evidence of a mistake in the estimates and has issued an order rescinding the proposals and enjoining the city.

Boston, Mass.—The engineers expect to have completed by cold weather that part of Boston's water system known as Basin 5, situated in the town of Southboro, most of the seven-mile open and covered aqueduct, and the two miles of aqueduct in Berlin cut through solid rock. This basin was planned and built by the city of Boston, but was not finished until it came into possession of the metropolitan board about a year ago. It is about 2,000 feet long and 75 feet above the ground; the foundation is 25 feet below the surface, making the wall 100 feet high; the masonry structure at the base is 75 feet wide; its storage capacity is 7,400,000,000 gallons; when filled the water will have a depth of 70 feet. It will take five years to build the Clinton dam, which will be of much greater magnitude than Basin 5.

CONTRACTS TO BE LET.

Albany, N. Y.—Bids are asked until Oct. 5 for ditching, draining and cast iron pipe culvert on the flats next north of Lumber district. George I. Bailey, supt. w. w.

Commerce, Tex.—Estimates are wanted for the construction of a water works system. W. W. Rutland.

Union, S. C.—Bids are asked until Oct. 12 for constructing a water works system. F. M. Farr, chrmn. comrs

DeKalb, Ill.—Bids will be received until Nov. 6 for the sale of the old water works plant. E. A. Porter, cy. clk.

Rock Island, Ill.—Bids are asked until Oct. 4 for furnishing 700 tons of 18-inch cast iron wate pipe. John C. Murrin, supt. w. w.

Ogdensburg, N. Y.—Sealed proposals will be received until Oct. 7 for one or two tubular steam boilers and for one 6,000,000-gallon steam pumping engine. H. A. Lord, supt. w. w.

Hull, England.—Bids are asked until Oct. 7 for furnishing plans and two sets of engines and pumps, each with a capacity of about 2,700,000 gallons a day. F. J. Bancroft, w. w. engr.

Lebanon, Pa.—Sealed proposals will be received until Oct. 18 for the development and furnishing of a guaranteed additional water supply of at least 1,000,000 gallons per day. I. L. Beckley, cy. clk.

West Monroe, La.—The contract will be let soon for 2,900 feet of 6-inch cast iron pipe; 4,000 feet 4-inch iron pipe, 20 pounds per foot, a 65,000-gallon steel tank on a steel tower to be supplied by a pump with 300,000-gallon capacity against 100 pounds pressure, also 12 street hydrants.

CONTEMPLATED WORK.

East Berlin, Pa.—The contract for building water works has been awarded to Bolton G. Coon of Kingston, Pa.

Bancroft, Neb.—The contract for constructing water works has been awarded to Fairbanks, Morse & Co. of Chicago for $6,987.

Vandalia, Ill.—The contract for building water works has been awarded to Charles A. Stookey of Belleville, Ill., for $45,000.

Marathon, N. Y.—The contract for constructing a water works system has been awarded to J. Monahan of Sharon Springs, N. Y., for $10,718.48.

Millerstown, Pa.—The contract for constructing a water works system has been awarded to Harmon P. Malone of Hollidaysburg for $10,000.

Rensselaer, Ind.—The contract for constructing a water plant has been awarded to the Chicago Bridge & Iron Co. for $37,000.

West Conshohocken, Pa.—N. C. Freck, Millersburg, Pa., has been granted permission to build a water works system for this place.

Baxley, Ga.—The contract for erecting water works has been awarded to the recently organized Atlanta Steam and Water Supply Co., H. B. Cooper, mgr.

Summerville, Ga.—The contract for constructing a system of water works and sewers was awarded Sept. 14 to Guild & White of Chattanooga, Tenn., for $33,000.

Scranton, Miss.—C. M. Buckhalter & Co. of Birmingham, Ala., secured the contract for constructing a water works and electric light plant for $20,686.

Sleepy Eye, Minn.—The contract for constructing a system of water works was awarded Sept. 6 to Fairbanks, Morse & Co. of St. Paul, Minn., for $5,950.

Sharon Springs, N. Y.—The contract for building the reservoir and laying water and sewer pipes has been awarded to Robert H. Strong of Albany for $33,708.73.

Buffalo, N. Y.—The contract for furnishing a 3,000,000-gallon vertical triple expansion pumping engine has been awarded to the Lake Erie Engineering Works of this city for $64,250.

Chicago, Ill.—The lowest bid received Sept. 7 for putting in a new 14,000,000-gallon pumping engine at Sixty-eighth street station was presented by the Lake Erie Engine Co., $32,650.

Center Hill, Pa.—Bids were received Sept 17 for constructing water works as follows: R. D. Wood & Co., Philadelphia, all material, $4,344.22; Jackson & Woodin Co. Berwick, all material, $4,348.50; J. S. Vipond, Altoona, all work, $4,385; H. P. Malone, Hollidaysburg, all work, $4,572; Matthew Smith, Altoona, all work except reservoir, $3,590; J. D. Mooney & Co., Wilkesbarre, all work except reservoir, $3,014; Humphreys & Rowe, Ashland, all work except reservoir, $3,350.

CONTEMPLATED WORK.

Crystal Springs, Miss.—A petition has been circulated for a water works system.

Fairmont, Minn.—The construction of a water works reservoir at Lake Rudd is contemplated.

Caldwell, W. Va.—This town has issued $15,000 in bonds for water works.

West Monroe, La.—The citizens have petitioned council to build, own and operate a water works system.

Cadiz, Ky.—A company is being formed by R. F. Goodwin and J. J. Alexander to supply water for this place.

McKinney, Tex.—A committee has been appointed to investigate the question of constructing water works.

Dodge City, Kas.—About $35,000 will be expended for improvements to the water works and electric light plants.

Sandusky, O.—The purchase of another pumping engine, at a cost of $25,000, is contemplated by the water trustees.

Dunkirk, Ind.—The question of improving the water works system is contemplated. J. B. Mendenhall, prest. comrs.

Elmwood Place, O.—Plans and estimates for a water supply will be prepared by E. F. Layman, C. E., of Cincinnati.

Tottenville (S. I.), N. Y.—The sum of $30,000 in bonds has been voted for municipal works. H. R. Yetman, engr.

Sullivan, Me.—This town has voted to have a water supply to be furnished by a company. George Simpson interested.

Vailsburg, N. J.—The question of issuing $16,500 in bonds for a water supply will be voted on. William Billington, boro. clk.

Mound City, Ill.—A. T. Dougherty is interested in the organization of a company to supply this place with water.

Rawlins, Wyo.—Surveys have been made for a large reservoir to be used for furnishing a water supply for this place.

Flushing (L. I.), N. Y.—A committee has been appointed to investigate the water supply, which is insufficient, according to reports.

Toronto, Ont.—The purchase of a 10,000,000 gallon pumping engine has been recommended by Chief Engineer Pink of the water works.

Statesville, N. C.—Bids for constructing water works will probably be asked soon after Oct. 15. L. Harrill, mayor.

Atlanta, Ga.—The question of issuing $200,000 in bonds for the extension of water mains throughout the city is under discussion.

St. Anne, Ill.—A. C. Shreipe may be addressed regarding the proposed granting of a franchise for a water works and electric light plant.

Roxboro, N. C.—The pumping engine for the water works system, which will be constructed at once, has not yet been purchased. R. M. Dowdy, mayor.

Holyoke, Mass.—The water supply will be filtered by means of a sand plant which will be built between the upper and lower reservoirs.

Marshall, Ill.—A committee has been appointed to investigate the best water supply. The question of issuing bonds will be voted on.

Abbeville, Ga.—A proposition is being considered by the town council to form a company to establish water works and electric lights.

Monroeville, O.—Plans and specifications for the proposed water works system will be made by Paul Voorhees, C. E., Buffalo, N. Y.

Whitestone, (L. I.) N. Y.—The question of issuing $10,000 in bonds for new water mains will be voted on Oct. 1. Moses Worms, treas. comrs.

College Point, (L. I.) N. Y.—The purchase of a pumping engine has been authorized, according to press reports, by the village trustees; estimated cost, $8,000.

Sioux City, Ia.—It is proposed that an additional water supply be obtained by making connection with a system of artesian springs situated seven miles north of the city.

Rock Island, Ill.—Plans are being prepared by J. A. Harmon, C. E., of Peoria, Ill., for a reservoir. About a mile and a half of new mater mains will be laid, also.

Salt Lake City, Utah.—Plans have been prepared by City Engineer F. C. Kelsey for improvements to the Fort Douglas water works; estimated cost, $5,000.

Albany, N. Y.—Plans were submitted and approved, Sept. 7, by Engineer Allen Hazen showing the land necessary for the construction of the filter plant.

Lansingburg, N. Y.—The question of issuing bonds to build a new reservoir will be voted on soon; estimated cost, $150,000. Wm. McLea, water comr.

The question of water works construction will be voted on as follows: Ortonville, Minn., Oct. 4; Hazlehurst, Miss., Oct. 4; Madisonville, Ky.; Reno, Nev.; Elkins, W. Va.; Corinth, Miss.

The question of issuing bonds for water works construction has been favorably voted on at the following places: Odell, Ill.; Billerica, Mass.; Mifflinsburg, Pa.; Monroe, N. C.; Mineral Point, Wis.

Beatrice, Neb.—An appropriation of $500 is reported for the expense of prospecting for a water supply for the northwest district of this city. Water Comrs. Grant and S. H. Davis interested.

Gas City, Ind.—Propositions are being considered by this town, according to press reports, to grant a franchise for water works, electric lights, etc. Councilmen Fowler, Harris and Easthwait, com.

Denver, Col.—The board of aldermen passed a resolution Sept. 10 transferring $1,000 to the board of public works engineering fund to enable it to prepare estimates for a municipal water plant.

Slater, Mo.—(Special.)—R. L. Harvey, Mayor, says the city council passed an ordinance Sept. 8 ordering an election for Oct. 4 on the question of incurring an indebtedness of $15,000 for the extension of the water works system.

Dyersburg, Tenn.—Plans and specifications for the proposed water and electric light plants have been prepared by Frank Schefiod of New Albany, Ind. The question of issuing $30,000 in bonds will be voted on Oct. 5. W. A. Fowlkes, Jr., mayor.

Jersey City, N. J.—According to press reports the water commissioners have asked the engineers to include in the specifications for a water supply a clause asking for bids from filtration companies. F. Henitze, chrmn. comrs.

The construction of water works is contemplated at the following places: Harrisonville, Mo.; Stanwood, Wash.; Osakis, Minn.; Barrington, Ill.; Savannah, N. Y.; Mt. Vernon, Ia.; Farmersville, Tex.; Northport, Wash.

Americus, Ga.—The question of issuing bonds will be voted on Oct. 19 for the following: Extension and improvement of water works, $15,000; extension and improvement of sewerage system, $10,000; grading streets, etc., $10,000.

Birmingham, Ala.—Madin Sloss, Fred Sloss, George C. Kelley and Caldwell Bradshaw are interested in a company that is being organized to construct a water works

plant, the supply to be obtained from the Gate City artesian well.

Chattanooga, Tenn.—In addition to the two new reservoirs and filter plant which are being constructed by the City Water Co., there will be required two 10,000,000-gallon pumping engines, a new pumping station, boilers, etc.

Nevada City, Cal.—Mrs. E. C. Hunt has agreed to sell the city water works to this city for $26,000. After the works are paid for a balance of $35,000 of the $60,000 derived from the issue of bonds in 1895 will remain, which will be applied to extension and other improvements to the system.

BRIDGES.

Buffalo, N. Y.—Plans have been accepted for a new bridge over the creek in Cazenovia Park.

Lewisburg, Pa.—The town council has decided to build a bridge on the extension of Third street, near Brown.

Circleville, O.—A petition is being circulated for the construction of a bridge across Deer Creek, at Dublin hill.

Rochester, Minn.—A steel bridge across the Zumbro river at Fifth street has been decided upon at a cost of $15,000.

Toms River, N. J.—Bids are asked until Oct. 21 for constructing an iron bridge over Toms river at Main street. D. O. Parker.

Norristown, Pa.—A new steel bridge is contemplated over Sawmill Run on E. Avery street; estimated cost, $17,000. Co. comrs.

San Diego, Cal.—Plans and specifications are being prepared by E. M. Capps, city engineer, for a bridge at Rose Canyon.

Chicago, Ill.—Sealed proposals will be received until Nov. 3 for constructing two bridges. Thos. Kelly, prest. bd. trus.

Jackson, Ky.—The question of issuing bonds for building a bridge across the river will be voted on Nov. 2. Town bd. trustees.

Cincinnati, O.—County Engineer Krug has been instructed to prepare plans for the construction of two bridges on the Muddy Creek road.

Dayton, O.—A draw bridge will be constructed over the canal at West Carrollton on the Deemer road by the county commissioners.

Port Huron, Mich.—Bids are asked until Oct. 4 for constructing a steel swing bridge across Black river at Tenth street. F. F. Rogers, cy. engr.

Mountain Home, Idaho.—Bids will be received until Oct. 15 for building a bridge across the South Boise river. W. H. Manion, clk. co. comrs.

Carlisle, Pa.—The construction of a joint bridge by the commissioners of Cumberland and York counties has been recommended by the grand jury.

Rochester, N. Y.—The question of building a new iron bridge below the Driving Park avenue bridge is being agitated; estimated cost, $150,000.

Cincinnati, O.—Bids are asked until Oct. 2 for constructing a wrought iron bridge across Taylor creek at Fowler Crossing. Eugene L. Lewis, co. audt.

Ludington, Mich.—The question of issuing $9,000 in bonds for building county bridges will be voted on Oct. 8. Geo. H. Barrett, Frank P. Sherman, co. supvs.

Waukegan, Ill.—Plans, specifications and bids will be received until Oct. 4 for the construction of a steel bridge near Warrenton Grove. E. B. Neville, chrmn.

Mankato, Minn.—Bids will be received until Oct. 6 for constructing two bridges across Wild Rice creek, and for repairing the bridge between Taylor and Weber townships.

Springfield, O.—Bids are asked until Oct. 4 for constructing a bridge and abutments on the boulevard over the creek near Lagonda. Samuel J. Wilkerson, cy. clerk.

Greensburg, Pa.—The county commissioners decided Sept. 18 to build a new iron bridge across Brush creek, on the road leading from Penn to Brush creek cemetery.

Springfield, Mo.—The Wrought Iron Bridge Co., Canton, O., was awarded a contract Sept. 6 for constructing a steel bridge over the Sac river, about five miles south of Ash Grove.

Columbus, O.—Sealed proposals will be received until Oct. 6 for the substructure and superstructures of two bridges on Dublin road and Hayden free pike. W. H. Halliday, co. audt.

Youngstown, O.—The contract for the substructure of the new Market street bridge has been awarded to Neidermier & Roster for $22,650, and the superstructure to the Mahoning Bridge Co. for $169,550.

Washington, Ind.—The board of county commissioners has been petitioned to call a special election to appropriate money for the purpose of building two bridges across White river, between this county and Knox county.

PARKS.

Los Angeles, Cal.—City Engineer Dockweiler has suggested a plan for connecting all the parks of this city by a chain of boulevards.

Minneapolis, Minn.—The improvement committee of the board of park commissioners estimate the cost of the proposed improvements to Minnehaha park for next year will be $51,800.

East St. Louis, Ill.—Although defeated recently in the scheme to secure a fine park site, the citizens have not abandoned the project, but will endeavor to again have the subject submitted to a popular vote.

Rochelle, Ill.—A syndicate composed of ten business men of the city has purchased sixteen acres of land four miles west of the city, which it will improve as a park. The officers of the company are: President, George E. Stocking; vice-president, C. E. Gardner; secretary, Howard A. Morris; treasurer, G. W. Hamlin; directors, M. D. Hathaway, E. L. Orput, David Kelly, and the other officers of the board.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Collinwood, O.—A plan will have to be adopted soon for the disposal of garbage and refuse.

Braddock, Pa.—The council is considering the question of purchasing a garbage crematory.

Canton, O.—The purchase of a garbage crematory, at an estimated cost of $8,000, has been recommended.

Binghamton, N. Y.—The report of the committee on garbage disposal has been

submitted to the board of health. Commissioner Powell interested.

Dubuque, Ia.—The committee on streets has reported in favor of giving a new street sweeper a trial, and if it shall prove successful, to purchase it.

Milwaukee, Wis.—An ordinance has been passed by the council providing for the issue of $120,000 in bonds for a municipal garbage disposal plant. George H. Benzenberg, Cy. Engr.

Los Angeles, Cal.—New specifications are being prepared upon which the next contract for street sprinkling will be awarded. The letting will be for three years. The present contract expires Dec. 31.

Grand Rapids, Mich.—Bids were received for constructing a garbage crematory Sept. 20, as follows: Engle Co., Des Moines, $14,425; Dixon Co., Findlay, O., $15,250; S. G. Smith Co., New York City, $12,975.

New York, N. Y.—The board of estimates allowed George Waring, commissioner of public works, Sept. 16, according to report, $25,000 to construct a separating machine for garbage at No. 408 E. Forty-eighth street.

Cleveland, O.—The garbage commission, consisting of Mayor McKisson, J. G. Cowles, J. W. Conger, Dr. W. H. Humiston and Councilman Dailey, has decided to ask for new bids for the collection and disposal of garbage and refuse.

St. Louis, Mo.—The erection of three garbage disposal plants is contemplated by private parties, by which the garbage which is now dumped into the river will be converted into salable products by the use of new machinery, invented by H. W. Beldsmeier.

Minneapolis, Minn.—Bids were received Sept. 10 for the collection and disposal of garbage for a term of five years, but it is thought that the bids will be re-advertised. James Forrestal & Co. bid $21,000 to $23,000 for five years' collection and delivery of garbage and dead animals at the crematory, and a total of about $43,000 for collecting and disposing of the sweepings, cut grass and household and store waste, except vegetables and fresh garbage.

Chicago, Ill.—The bids received for the collection, removal and disposal of garbage were as follows: James H. Burke, $2,625,000; Campbell & Turner, $1,962,000; Hanrahan & Downey, $3,158,000; A. J. Murphy, $1,251,351; George B. Gillman, $2,579,000; Henry McDonald, $2,725,000; Mulcaire & Burke, $1,827,749; Dowdle & Chamberlain, $2,875,322; J. Bradley & Co., $1,600,000; Thomas A. Smyth, $2,080,000.

New Orleans, La.—One of the plans proposed for the disposal of garbage contemplates the dumping of collectors' carts on special platform from where, after boys have separated from it all salable portions, such as rags, paper, bones, metal, etc., the worthless refuse is transferred, by means of chutes, into dump scows. The salable portions taken out are washed, boiled or otherwise cleaned and temporarily stored, and it is estimated that ten tons of paper, worth $8 a ton, and two tons of bones, worth $12 a ton, are received daily, which sales would bring a yearly revenue of nearly $40,000. L. E. Marion is the promoter of the scheme.

Chicago, Ill.—L. E. McGann, commissioner of public works; James Kipley, general superintendent of police, and John Fitzsimmons, superintendent of street and alley cleaning, have had a card distributed bearing their signatures, forbidding the throwing of waste paper, straw, parings of fruit or vegetables, stone, glass, iron or other metal, article or things, except ashes on unpaved streets or alleys, in any street, alley, lane, public place or any uninclosed grounds in the city, under the penalty of not less than $5 nor more than $25 for the first offense, with liability to imprisonment for not less than one week nor more than three months in the house of correction for every subsequent offense.